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ABSTRACT

Included are seven lesson plans for secondary school students: (1) soil investigations; (2) water investigations; (3) forest investigations; (4) investigating some animals and their environment; (5) a land use simulation; (6) investigating the human community; and (7) developing environmental investigations. Each lesson plan has seven components: (1) suggestions for setting the stage; (2) individual or group activities; (3) task cards for activities; (4) charts and tables for data interpretation; (5) suggested questions and discussion points; (6) anticipated behavioral outcomes; and (7) a list of equipment needs. (RE)

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INVESTIGATING YOUR ENVIRONMENT

TEACHING MATERIALS FOR ENVIRONMENTAL EDUCATION

FOREST SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE

OCTOBER 1978

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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an introduction to the

INVESTIGATING YOUR ENVIRONMENT SERIES

Making decisions about the management of our environment becomes a little easier if we understand what makes up that environment and how our actions affect it. The processes and techniques contained in these investigations enable people to examine different components of the environment and help them to understand the relationships among these components.

The investigations encourage participants to observe their surroundings and to collect, record, and interpret data. Facts and figures are collected as a means toward gaining a deeper understanding, not as an end in themselves. The questions and discussions are designed to elicit maximum response and involvement from the participants and to eliminate lecturing and show-and-tell activities. Each lesson plan provides a framework within which succeeding activities and discussions build on what has been learned before, leading the participants to an understanding of environmental relationships. A knowledge of these relationships provides the basis for better understanding of environmental problems and their possible solutions.

One of the goals is to help individuals develop the skills and motivation to interact with their environment at many different levels. The materials (lessons and tasks) in this series are designed to contribute to that goal because they allow participants to investigate the environment by:

- Collecting, recording, and interpreting information about different parts of the environment
- Applying these interpretations by analyzing physical, social, and economic impacts on the environment in a variety of situations.

The lesson plan for each investigation has seven components:

- Suggestions for setting the stage
- Individual or group activities
- Task cards for some activities
- Charts and tables to be used in data interpretation
- Suggested questions and discussion points
- A statement of anticipated behavioral outcomes
- List of equipment needs.

The main framework of the lessons is the Interpretation of Data Process. This process has been adapted by permission from the course, "Development of Higher Level Thinking Abilities," 1968, Northwest Regional Education Laboratory, Portland, Oreg. The course deals with thinking tasks concept formation, interpretation of data, and the application of these data, as defined in the parent material.

This Interpretation of Data Process, used throughout the lesson plans, allows people to make their own interpretations about the environment using the observations and information that they collected. It involves four basic types of "tasks."

TASK	RESULT
– Open	Produces a large body of data Allows everyone to participate
– Focus	Zeros in on the topic or topics to be investigated

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TASK	RESULT
– Interpretive	Looks for contrasts and similarities, causes and effects, and other relationships between the focus topics
– Summary	Allows group to summarize its findings

Task cards are an integral part of each investigation and are important because they:

- Promote small group interaction and data collection
- Allow for individualized study
- Allow for people with different levels of ability to participate at the same time
- Are success oriented
- Place responsibility for learning on the participant rather than the teacher.

Some of the interpretive tasks use charts, tables, and other factual material as a basis for making more accurate interpretations of the data collected. This can further place the responsibility for learning on the participant and allows the teacher or leader to faciliate the activities and learning experiences even if he or she is unfamilier with the material.

The summary questions and discussions at the end of each "task" and each Investigation are among the most important activities. They are designed to:

- Allow each person to contribute to the group's understanding
- Allow each person to summarize into generalizations or conceptual ideas the data they have collected and interpreted
- Allow each person to analyze the processes and methods used by the group to collect, interpret, and summarize data.

This process can become a valuable tool by:

- Developing environmental investigation that allows groups to pool their skills and knowledge in collecting and interpreting their own information
- Giving a group leader a way to identify where the group is in their level of understanding of a topic
- Allowing everyone an opportunity to participate at their level of interest and motivation
- Allowing a group to work together in problem-solving situations
- Allowing the group to summarize its own findings, values, and feelings before comparing them with other groups, specialists, or professional opinions.

Conducting an Investigation

The lesson plans are self-explanatory, although there are some aspects of the overall process that need to be emphasized.

Preparation

1. Select the site and dry run the investigation on the site.
2. Plan to pace the session so that each activity can be done well.
3. Use the lesson plan as a guide, especially for the questions and the discussion periods. Once the plan has become familiar, do not hesitate to revise it as necessary.
4. If there will not be enough time to do an entire investigation, decide in advance which activities should be omitted. Do not become trapped into moving so quickly that the participants are provided data rather than being allowed to collect it. Always allow ample time for the summary questions.
5. Make sure that there is enough equipment and that it is in working order.

Beginning

1. Set the stage for what will happen during the session. Refer to the introductory paragraphs in each lesson.
2. Before leaving for the study area, have the participants discuss what effects the investigation itself may have on the environment and possible hazards that may be encountered.
3. Arrange for checking out and returning the equipment. Usually it is best to have one or more participants do this.

Implementation

1. Be sure to give clear directions. Do not be reluctant to read or write directions. Experience has shown that ad libbing instructions often changes and confuses the meaning.
2. Listen to what the participants say and accept all their contributions.
3. Refocus on the original question if the discussion digresses.
4. Allow adequate time for the final summary and discussion. It may take as much as one-half hour. This discussion is extremely important because it concentrates on the application of what was learned during the investigation.
5. When appropriate, discuss how the investigation can be used in classrooms or on schoolgrounds, and especially how environmental studies can be integrated into various subject areas in the school curriculum.
6. Consider using the summary discussion as an evaluation tool.

Conclusion

1. Constantly be alert for opportunities to expand, adapt, and improve subsequent investigations.
2. The ideas and activities presented in these teaching materials will come to life only as you try them, modify them, and improve them to fit your own needs, style, and situation.

All of these materials are for public use and may be reproduced without prior permission. They were developed by many people from many different groups who shared the objectives of better environmental education through involvement. They have been successfully used at environmental education workshops throughout the country.

Specific materials and ideas in this packet are used with the permission of:

- Oregon and Washington Environmental Education Group
- Northwest Regional Education Laboratory, Portland, Oreg.
- Michael Giammatteo, Ph.D., Sylvan Institute of Mental Health, Vancouver, Wash.
- Journal of Geography.

a lesson plan for

A PROCESS AND PROBLEM-SOLVING APPROACH TO ENVIRONMENTAL EDUCATION

Set the stage for this session by reviewing quickly what will take place in the allotted time. For example, "In this session we will identify some techniques and processes for group problem-solving. We will then use these processes to solve a couple of problems and discuss their values.

I. SOLVING A PROBLEM THROUGH GROUP INTERACTION

Have audience arrange themselves in groups of six, or group chairs this way ahead of time. Pass out the "Bits of Information" problem, one bit of information to each person. (Use one of the problems at the end of this lesson plan.)

Tell the groups, "There is a problem to solve; you have all the information in your group needed to solve the problem. The only information you need from the facilitator is printed at the top of each bit of information. It says, *'Although you may tell your group what is on this sheet, you may not pass it around for others to read.'*"

Repeat instructions again to the whole group. If people tell you they don't understand, just repeat the instructions. After about 5 minutes into problem, pass out paper and marking pens. Write on board:

Trust Visual Display Matrix (chart)

Tell audience, "If the words on the board and the markers and easel paper passed out to you can help your group solve the problem, please use them."

As groups finish the problem, they may ask you for the right answer. Refer to the bit of information card held by one member of their group that tells them there is only one right answer and they can prove it. Ask them to verify their answer with another group. The purpose is not for the facilitator to tell a group that they are right or wrong, but for groups to develop trust in their own ability to solve problems and verify their findings.

Questions and Discussion

1. After all groups have finished the problem (20-30 minutes maximum), ask the following questions:

   a. "What kept you from solving the problem to begin with?"

   b. "What helped you to solve the problem later?"

2. "The people who developed this exercise felt that it contains elements of involvement that most groups go through to solve common problems. They hypothesized that the following things would take place during the problem-solving exercise." Write on board:

Trust Ritualistic listening Real listening -Vision -Space -Noise

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a. Trust - It is difficult for problem-solving to occur if people do not trust or feel comfortable with other people. You must trust that the facilitator gave you a solvable problem and that others in your group are communicating the information they have.

b. Ritualistic listening - This is a kind of polite listening because the data or information offered has no relevance at that time. Many speeches, introductions, etc., are often listened to ritualistically.

c. Real listening - When real problem-solving begins to take place, the kind of listening going on is very real because the information shared begins to mean something. People interrupt to say, "Please repeat that."

When real listening occurs, three things will change:

Vision - Participants will begin real listening by really looking at other people and constructing a visual display (writing data in a common place).

Space - Space factors will change:
People will usually move closer together.
People will sometimes change places or move around the table.

Noise - The noise level will go up when groups start working together.

3. "Using this type of activity at the beginning of a session can be important for several reasons."

a. It can be used as an icebreaker with a new group.

b. The problem could not be solved without the contributions of each person in the group.

c. People feel more committed to a session if they contribute by saying something, the earlier the better.

d. It's easier to talk to each other in a small group than to talk to one instructor in front of a large group.

e. This exercise illustrates that each person in a group brings information and skills that can be used by the entire group to solve common problems. The pieces of paper represented the information and skills that each of you brought to the group.

4. "We will be concerned in this workshop with providing ways for each person to contribute knowledge, information, and skills to the solving of common problems. The content and activity itself are not always the most important—what is important is the idea that you can use different techniques to get people talking to each other and contributing as a group."

5. *"None of us is as smart as all of us."* Put up a chart with this printed on it or write this on the board.

II. OBSERVING AND CLASSIFYING TREE LEAVES

Questions and Discussion

1. "Let's transfer some of the problem-solving factors to another activity." Distribute six different tree specimens, a different one to each person in a group.

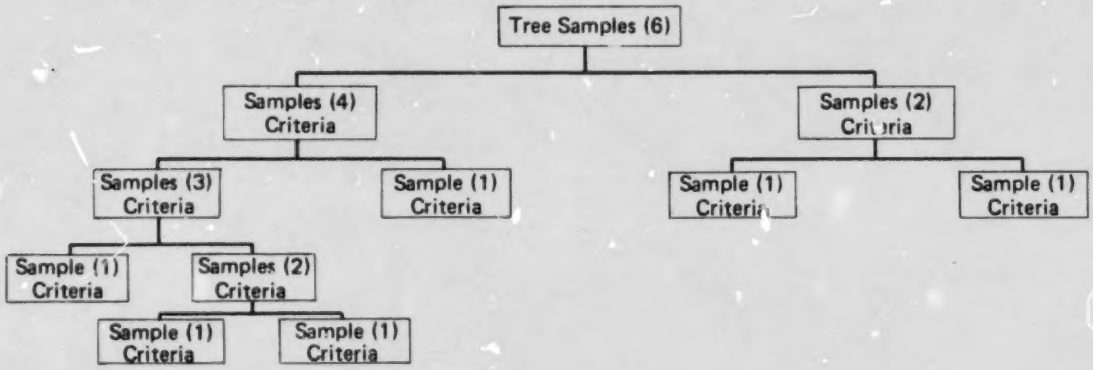
2. "Take your own leaf specimen and look at its observable leaf characteristics. Since we are looking at observable characteristics, we won't be concerned with the name of the specimen."

3. After a minute, have each person share the observable characteristics of his or her sample with other members of the group (about 4 minutes).

4. "Now each group put all the leaf specimens into two piles, on the basis of the major likenesses and differences of their leaf characteristics. Write down one criteria or reason you used to do it."

5. Ask each group to tell the criteria or reason used. List them on the board. Examples: long vs. short, round vs. flat, etc.

6. "Your next task is for each group to construct a classification key. Construct the key using your own criteria as a starting point for putting the samples into two piles. Divide each pile into two more piles of samples based on the major likenesses and differences of their leaf characteristics. Continue dividing piles until you have only one specimen left in each pile. This is one way to make a key– you may want to use another way." Give each group a piece of paper and marker. Tell each Group to construct its key so everyone can see it. As you explain point 6, draw the key on the board, e.g.:



III. COMMUNICATING ABOUT THE TREE SPECIMENS

"Now that your group has finished, select one sample, and using the words in the key that describe that sample, write a description of it in sentence form." Print this instruction on the board.

Questions and Discussion

1. (After most of the groups have finished writing the sentence) "One person from each group read your group's description, and the other groups hold up the sample they think is being described. The other members of the group whose description is read should check to see if the other groups selected the right sample." You may have to ask people to hurry so as not to drag out this part. It is important, however, for each group to read its description.

2. (After all descriptions have been read) "How could we use this classification activity to improve communications among people?" (Form committee, common vocabulary, etc.)

3. "What else can we do with this key?"
   Sample responses:

   a. *Demonstrate ability to use the key by adding a new tree sample.* Have additional sample to pass out to each group to see if it fits into the key.

   b. *Describe the difference between the key you make and another one.* "Change keys with the group next to you. See if you can match up the samples and then compare the two keys."

   c. *Take the key outside to use it in finding the trees or adding new ones.* This can be security for teacher and student– the student builds a tool and develops a skill in the classroom and gets to use that tool and skill in the outdoor classroom. The teacher doesn't need to know the names of trees to provide a meaningful learning experience for the student."

4. What do you know about the specimens now that you did not know when we started? We haven't even talked about names of these trees yet. Names may not be important to begin with. This classification process allows us to become familiar with the observable characteristics of the specimens. Now we are ready to use other written or picture keys to associate our descriptions with others and to find a name that society has given the

tree." Use books with picture keys, such as *Trees to Know in Oregon and Washington and Important Trees of Eastern Forests,* which usually are available at the local Forest Service, State Forester's Office, or book stores.

IV. DESCRIBING CURRICULUM RELATIONSHIPS WITH TREE PARTS. (Optional, depending on needs of group)

Questions and Discussion

1. "What other parts of trees can we use to classify?" List as column 1 on the blackboard or easel paper.

2. "In what curriculum areas can we use these parts of trees?" List as column 2.

3. "What are some examples of how they could be used?" List as column 3.

	(1) PART OF TREE	(2) CURRICULAR AREA USED (Art, Math, S.S., Sc., etc.)	(3) HOW USED
(e.g.)	Bark	Art	Construct mosaic
	Shape		Classify different
	Leaves		textures, compare
	Branches		texture, patterns
	Wood		and designs of
	Cones		different kinds of
	etc.		bark

4. "Many people feel that classifying is strictly a science process, and can't or shouldn't be used in other subjects. We have just disproved that theory by showing that we can classify different parts of trees and use them in many parts of the curriculum."

5. "What other things in the environment can we classify (for example shoes, people, rocks, communities, and animals)?"

6. (Optional, depending on time constraints; 10 minutes) Have each group select a group of objects in the immediate environment and develop a classification key about them. Share results.

V. DESCRIBING VALUES AND PROCESSES

Pass out this lesson plan and have groups do Task A (about 10 minutes).

TASK A (pairs or small groups)

1. Describe the values of classifying things in the environment.

2. Give an example of the use of classification as a tool in environmental management.

Questions and Discussion

1. "What are some values you've listed or talked about?" Sample responses might include: Because of group interaction you often look at things in a different way; it simplifies our information gathering and facilitates retention of knowledge; it is useful for previous history or future predictions; we each looked at it from our own frame of reference.

2. "What are some examples of the use of classification as a tool in environmental management?"

3. Have groups turn to Task B and discuss in groups which of the processes listed below were used so far in the session (about 10 minutes).

TASK B (Small groups)

Mark the processes used in this activity and give an example of how they were used.

PROCESS	EXAMPLE OF HOW USED
OBSERVING: Learner uses several of the senses (tasting, feeling, seeing, hearing, smelling, etc.) to collect data about environment.	
MEASURING: Using standard units of measure and "invented" units to determine quantity, quality, and extent.	
CLASSIFYING: After determining similarities and differences, learner places objects, ideas into groups or categories.	
INFERRING: On the basis of collected data and observations, learner can determine some possible reasons for observation.	
PREDICTING: On the basis of current data and experience, learner foretells future events, conditions, etc.	
COMMUNICATING: Learner can present information and ideas to others in verbal and nonverbal forms.	
FORMULATING HYPOTHESES: On the basis of preliminary experience and inferences, the learner establishes the direction for further inquiries.	
EXPERIMENTING: Learner seeks to find answers to an unsolved problem through various methods of testing, data collection, and interpretation.	
INTERPRETING DATA: Collected data are organized and compared with previously verified data in order to determine meaning.	

This list was adapted from materials developed by the American Association for the Advancement of Science for the Project AAAS Commission on Science Education.

VI. SUMMARY

1. "In what ways were the six bits and tree classification activities similar?"

2. "What did we find out about problem-solving techniques in this session?"

3. "How can we summarize our discussions and activities?"

4. "The things we've just done are typical of the processes that we will use here. Although we will be investigating one environment, the same type skills and processes are transferable to the investigation of any environment."

5. "These types of skills and techniques can assist us in setting up problem-solving experiences for people to learn more about their role in the management of their environment."

6. You may want the participants to evaluate the sessions by writing how they felt about the session.

VII. SOME OBJECTIVES

Behavioral Outcome in Knowledge

1. As a result of this session, each participant should be able to:

   a. Identify at least six factors that take place within a group to make it work more effectively together.

   b. Identify and describe nine processes and their use in environmental data collecting and interpretation, and problem-solving.

Behavioral Outcome in Feelings, Awareness, Values, and Action

2. As a result of this session, each participant should be able to:

   a. Describe the values of classifying things in the environment.

   b. Describe the values and give examples of the use of classification as a tool in environmental management.

   c. Describe how this problem-solving process can help people work together better.

VIII. EQUIPMENT NEEDED

Blackboard and chalk, or easel, newsprint, and markers.
Enough *Six Bits of Information* problems cut up for the small groups.
Tree leaf samples in sets of six for the small groups.
Optional: Picture keys, such as *Trees to Know in your Local Area.*

"SIX BITS OF INFORMATION" PROBLEM

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$B_1{}^1$

You may tell your group what is on this slip, but you may not pass it around for others to read.

Information

All teachers taught at the same time and exchanged groups at the end of each period.

Each teacher liked a different group best. Each teacher taught the group he liked best during the fourth period.

Carl was the team leader for the intermediate unit.

$B_1{}^2$

You may tell your group what is on this slip, but you may not pass it around for others to read.

Information

The team leader taught the Buckaroos during the first period.

Working out a schedule was difficult because Carl and Dottie wanted Edward to work with them during the same period.

Edward and Frieda could never agree on which group was easiest to handle.

$B_1{}^3$

You may tell your group what is on this slip, but you may not pass it around for others to read.

Information

Your group members have all the information needed to find the answer to the following question. Only one answer is correct. You can prove it.

IN WHAT SEQUENCE DID DOTTIE TEACH THE VARIOUS INSTRUCTIONAL GROUPS?

Some of the information your group has is irrelevant and will not help solve the problem.

$B_1{}^4$

You may tell your group what is on this slip, but you may not pass it around for others to read.

Information

Dottie taught the Freewheelers during the second period.

The Jets had three more members than the Aces.

The Jets had Agnes for a teacher during their third period.

$B_1{}^5$

You may tell your group what is on this slip, but you may not pass it around for others to read.

Information

Each teacher taught every group during one of the first four periods of the day.

During the first period Agnes taught the Aces.

Of all the groups, Bob liked best to work with the Aces.

$B_1{}^6$

You may tell your group what is on this slip, but you may not pass it around for others to read.

Information

The Howell Elementary School Intermediate Unit had four teachers, two teachers aides, and four instructional groups of students.

Each instructional group had chosen its own name.

"SIX BITS OF INFORMATION" PROBLEM

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$B_2{}^1$

You may tell your group what is on this slip, but you may not pass it around for others to read.

Information

The Dinosaurs had Tom for a teacher during the third period.

Dick and Belinda did not get along well and so they did not work together.

During the first period the Team Leader taught the group that Harry liked best.

$B_2{}^2$

You may tell your group what is on this slip, but you may not pass it around for others to read.

Information

All teachers taught at the same time and exchanged groups at the end of each period.

Each teacher liked a different group best. During the second period each teacher taught the group he liked best.

Each teacher taught every group during one of the first four periods of the day.

$B_2{}^3$

You may tell your group what is on this slip, but you may not pass it around for others to read.

Information

The Freznel Elementary School Intermediate Unit had two teacher's aides, four teachers, and four instructional groups of students.

Each instructional group had chosen its own name.

Sybil was the Team Leader for the Intermediate Unit.

$B_2{}^4$

You may tell your group what is on this slip, but you may not pass it around for others to read.

Information

Your group members have all the information needed to find the answer to the following question. Only one answer is correct. You can prove it.

IN WHAT SEQUENCE DID THE APES HAVE THE VARIOUS TEACHERS DURING THE FIRST FOUR PERIODS?

Some of the information your group has is irrelevant and will not help solve the problem.

$B_2{}^5$

You may tell your group what is on this slip, but you may not pass it around for others to read.

Information

Belinda and Ralph disagreed about how it would be best to handle the Bombers who always had trouble settling down to work.

Dick preferred to work with the Champs over all other groups.

Although the Team Leader had been at Freznel School for five years, this was a shorter period of time than for the other team members.

$B_2{}^6$

You may tell your group what is on this slip, but you may not pass it around for others to read.

Information

The Team Leader taught the [illegible]saurs the second period.

Harry worked with the Bo[illegible]bers in the third period.

Sybil had been at Freznel School a shorter period of time than any of the other teachers in the Intermediate Unit.

TASK B (Small groups)

Mark the processes used in this activity and give an example of how they were used.

PROCESS	EXAMPLE OF HOW USED
OBSERVING: Learner uses several of the senses (tasting, feeling, seeing, hearing, smelling, etc.) to collect data about environment.	
MEASURING: Using standard units of measure and "invented" units to determine quantity, quality, and extent.	
CLASSIFYING: After determining similarities and differences, learner places objects, ideas into groups or categories.	
INFERRING: On the basis of collected data and observations, learner can determine some possible reasons for observation.	
PREDICTING: On the basis of current data and experience, learner foretells future events, conditions, etc.	
COMMUNICATING: Learner can present information and ideas to others in verbal and nonverbal forms.	
FORMULATING HYPOTHESES: On the basis of preliminary experience and inferences, the learner establishes the direction for further inquiries.	
EXPERIMENTING: Learner seeks to find answers to an unsolved problem through various methods of testing, data collection, and interpretation.	
INTERPRETING DATA: Collected data are organized and compared with previously varified data in order to determine meaning.	

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a lesson plan for

SOIL INVESTIGATION

Set the stage for this investigation by reviewing quickly what will take place in the allotted time. For example, say: "In this session we will develop some skills in collecting, recording, and interpreting data about soil environments. We will then apply these data in making some decisions about how to use this land."

Note to facilitator: Both the metric and English systems of measurement are included in the lesson plan. If it has not already been determined, you should discuss and decide with the group which system will be used.

I. DESCRIBING SOIL

Distribute Task A and have the group complete it before going to the study sites. (5 minutes)

> TASK A
>
> Write your own description of soil. Keep this description for reference later.

II. OBSERVING AND RECORDING THINGS IN THE SOIL

Go on to Task B.

1. Have participants do Task B, step 1, before going to study site. (5 minutes)
2. Travel to study site. Have participants do Task B, steps 2 and 3. (15 minutes)

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TASK B (small groups)

1. Predict what you will find in the top few inches (centimeters) of the area to be studied. List your predictions.

2. Select an area about 2 feet (61 cm) square on the ground and sift through the top 3 inches (7.6 cm), recording the evidence of plants and animals you observe. Replace the ground in as near original condition as possible.

Name or description of item in the soil	Quantity	Possible effect on soil

3. The terms litter, duff, and humus are used to describe organic matter at the top of the soil. From your study above, complete the following chart

Term and definition	Describe the feel	List the identifiable parts of plants and animals you found
Litter (identifiable dead things on surface)		
Duff (partially decomposed organic matter - compacted		
Humus (almost completely decomposed nonidentifiable organic matter)		

Questions and Discussion

Discuss the terms litter, duff, and humus. Have participants pick up samples of litter, duff, and humus from the area they're standing on.

1. "What did you find?"
2. "How do you think the organisms you found affect the soil?"
3. "What might be some reasons for the odors in the soil?"
4. "Under what conditions would you expect to find more or different organisms?"

III. DEVELOPING THE SKILLS TO COLLECT SOIL DATA

Questions and Discussion

Move the group to a soil profile or soil pit.

1. "What do you see as you look at this cross section or profile of soil?"
2. "What are some things we might want to find out about this soil?"

Comment to the group, "The various conditions and characteristics of soil that you have mentioned, such as color, texture, structure, temperature, and acidity and alkalinity (pH), affect the way land can be used. Knowledge of these conditions is essential to land use planning, whether in a forest or in your backyard. We are going to collect, record, and analyze some information about those soil characteristics." Distribute Task C and refer to instructions on the back side.

Discuss and demonstrate how to collect data about the following soil characteristics using the instructions on the back side of Task C. This instructional session is extremely important. The participants need the skills they develop in this session when they collect data for the micromonolith. Demonstrate and discuss what you are doing as you proceed, and draw on the participants for most of the observations. For example, in demonstrating texture you may want to have samples of sand, loam, and clay in cans. Have participants feel these samples before determining the texture of the soil layers in the profile. You may want to demonstrate the use of the pH kit in front of the whole group. Use some foreign material such as cigar ashes, a rotten log, or coffee.

IV. CONSTRUCTING A SOIL MICROMONOLITH

Refer to Task C. Explain that there is a place to check or record the data collected and a place to sketch how the soil looks.

Display the materials available (jars, jelly cups, baggies, etc.) and demonstrate how they are used to construct a micromonolith. (45-60 minutes)

TASK C

Using the information on the back of this task, and the available equipment, record your observations below. Make a micromonolith using the materials provided.

Sketch your soil profile, label the layers or horizons, and record the data.

PROFILE SKETCH

DATA

Air temperatures:
3 ft. (91.4 cm) above surface _____
Just along surface _____
Contents of layers above top soil (if existing):
Litter _____
Duff _____
Humus _____
Total depth of layer above top soil _____

Topsoil (a horizon):
Depth _____ in. (cm) to _____ in. (cm)
Color _____
Texture: Sandy ____ Loamy ____ Clayey ____
Structure: Columnar ___ Blocky ___ Platey ___ Granular ___
pH _____
Temperature _____°F (°C)
Plant roots visible _____

Record below the same information for the other layers.

Describe type of rock in the bedrock (if present).

COLLECTING INFORMATION ABOUT SOIL CHARACTERISTICS

1. *Soil layers* (horizons). Mark where the soil changes color and general appearance. Many soils have three major layers or horizons: top soil, subsoil, and parent material. Because soil formation has many variables, you may find more or fewer layers.

2. *Color*. Describe the color of each major layer, using your own descriptive terms. Moisten soil to get a more accurate color description.

3. *Texture* (how the soil feels). Determine the texture of each major layer. Testure is determined by the feel. Rub a moistened sample of soil between thumb and forefinger. Spit on sample to moisten, if water is not available.
   If it feels very gritty and not plastic– sandy
   If it feels smooth and slick, or somewhat gritty and sticky– loamy
   If it feels smooth, plastic, very sticky– clayey

4. *Structure* (how the soil is put together in geometric shapes). Determine the structure of each major layer. Carefully break apart a shovelful of soil from each layer and match its characteristics with one of these structure words: Blocky
   Columnar
   Granular
   Platey

5. *Temperature*. Determine the temperature of each layer. Use the soil thermometer.

6. *pH* (acidity or alkalinity). Determine the pH of each major layer. Soil pH is an indication of how well certain plants can grow in the soil. Put a small sample of the soil to be tested in a porcelain dish. Do not touch the sample. Use just enough pH reagent to saturate the soil sample. Match the color of the pH reagent at the edge of the soil sample with pH color chart.

Each person should *construct a soil micromonolith* (Task C). A micromonolith is a small model of a soil profile in which samples of each soil layer are attached to a card.

V. ANALYZING THE SOIL DATA

After the group finishes Task C, distribute Task D. Discuss this task by reading the instructions with the whole group and going over the first task on soil depth.

It may be important to have local plant identification books, picture keys, etc., for use by participants in interpreting the soil data tables on the back of Task D. (20-30 minutes)

TASK D (individuals or small groups)

ANALYZING SOIL DATA

Using the soil data you collected and the information provided in the soil data tables on the other side of this Task, complete the following.

1. On the basis of soil depth, complete the following (refer to Table I).
   The potential of my soil for water storage is _____.
   Why? _____.

2. On the basis of color, complete the following (refer to Table II).

   a. The top soil, or A horizon:

      Amount of organic material _____.
      Erosion factor _____.
      Fertility _____.

   b. The drainage in the subsurface soil, or B horizon, is: _____
      _____.

3. On the basis of texture, complete the following (refer to Table III).

Layer or horizon	Water holding capacity	Looseness of soil
Topsoil A		
Subsoil B		

4. On the basis of structure, complete the following (refer to Table IV).

Layer or horizon	Penetration of Water	Drainage	Aeration
Topsoil A			
Subsoil B			

5. On the basis of pH ranges, complete the following (refer to Table V).

Some plants that could grow here according to the soil pH plant chart	Some plants actually observed growing here

   How well did the plants in the study area check out with the pH you measured?

   Describe in a short paragraph how you would set up an experiment to collect data and construct your own soil pH plant chart.

6. On the basis of the soil temperatures, complete the statement below (refer to Table VI): The plants on my soil have _____ growth taking place now. I predict that in 3 months the growth conditions of the soil, on the basis of soil temperature, will be _____.

7. Write a soil description about this soil using the words from the data you collected and recorded on the soil micromonolith card. Compare this description with the one you wrote at the beginning of the session.

SOIL DATA TABLES

TABLE I. RELATIONSHIPS OF SOIL DEPTH TO PLANT GROWTH AND WATER STORAGE

Soil Depth	Water Storage
Deep Soil (over 42" or 1.1 m.)	Excellent water storage and plant growth
Mod. Deep Soil (20"-42" or 0.6-1.1 m.)	Good water storage and plant growth
Shallow Soil (20" or 0.6 m. and under)	Poor water storage and plant growth

TABLE II. SOME RELATIONSHIPS OF COLOR TO SOIL CONDITIONS

A. TOPSOIL (A HORIZON)

Condition	Color		
	Dark (dark gray brown to black)	Moderately dark (brown to yellow-brown)	Light (pale brown to yellow)
Amount of organic material	High	Medium	Low
Erosion factor	Low	Medium	High
Aeration	High	Medium	Low
Available Nitrogen	High	Medium	Low
Fertility	High	Medium	Low

B. SUBSURFACE SOIL (B HORIZON)

Subsurface soil color	Condition
Dull grey (if in low rainfall soils 0-20")	Water-logged soils, poor aeration
Yellow, red-brown, black (if in forest soils)	Well-drained soils
Mottled grey (if in humid soils)	Somewhat poorly to poorly drained soils

TABLE III. SOME EFFECTS OF TEXTURE ON SOIL CONDITIONS

Texture	Water holding capacity	Looseness of soil
Sandy	Poor	Good
Loamy	Good to excellent	Good
Clayey	High (water held too tightly for plant use)	Poor

TABLE IV. SOME EFFECTS OF STRUCTURE ON SOIL CONDITIONS

Structure	Penetration of water	Drainage	Aeration
Columnar	Good	Good	Good
Blocky	Good	Moderate	Moderate
Granular	Good	Best	Best
Platey	Moderate	Moderate	Moderate

TABLE V. RELATIONSHIPS OF SOIL pH TO PLANT SPECIES

3.5 4.5 6.5 7 8.5 14

(3.5 to 4.5 is too acid for many plants) (Most plants do best here) (8.5 to 14 is too alkaline for most plants)

Some examples of soil pH plant indicators:

pH 4.0-5.0: Rhododendrons, camellias, azaleas, blueberries, some ferns, hemlocks, some pines and spruces.

pH 5.0-6.0: Some pines, firs, holly, daphne, some spruce, oaks, birch willow, rhododendron.

pH 6.0-7.0: Maple, mountain ash, pansy, asters, peaches, carrots, lettuce, pines, firs, ash, basswood elm, yellow poplar.

pH 7.0-8.0: Mock orange, asparagus, sagebrush, red cedar.

Note: These relationships may vary slightly in different environments.

TABLE VI. SOME RELATIONSHIPS OF SOIL TEMPERATURE TO PLANT GROWTH

Soil temperature	Plant growth during growing season
Less than 40°F (4.4°C)	No growth, soil bacteria and fungi not very active
40°F – 65°F (4.4°C – 18.3°C)	Some growth
65°F – 70°F (18.3°C – 21.1°C)	Fastest growth
70°F – 85°F (21.1°C – 29.4°C)	Some growth
Above 85°F (29.4°C)	No growth

Questions and Discussion

1. "Using the observed color of the top layer, and Table II, A and B, what did you say about the erosion factor of your soil?"

2. "Using the structure of your soil and Table IV, what did you say about the drainage of water?"

3. "How well did the plants in the study area conform to the soil pH plant chart?"

4. Have groups read how they would set up their own soil pH/plant chart. Point out that soil scientists determine soil pH and record the plants growing in the area to construct a table or chart for use in interpreting soil pH/plant relationships elsewhere.

5. If there is a Soil Conservation Service soil survey report describing local soils available, read its description of the soil just studied. Point out that these reports are prepared from the same information we used. Compare the Soil Conservation Service's description with the participants' descriptions. Usually the descriptions are very similar.

6. "How does this soil description differ from the one you wrote in Task A?"

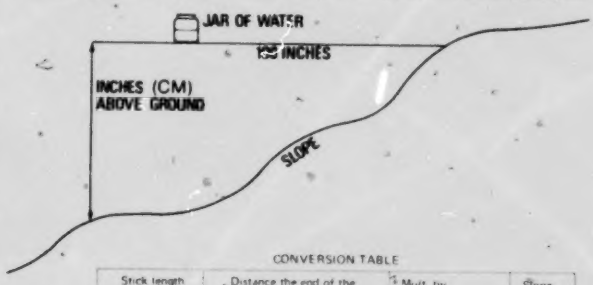
VI. MEASURING THE SLOPE OF THE LAND

"In addition to the other data we have collected, measurements of the slope of the land are needed in order to discuss possible uses of the study area. If the slope is varied, measurements from several locations may be needed to obtain a more accurate average." Pass out Task E. (10 minutes)

TASK E

MEASURING THE SLOPE OF THE LAND

1. Select a place that represents the average slope of the land being studied or take several measurements and average them.
2. Place one end of a 100-inch (100 cm) stick on the slope you want to measure. Hold stick so it is about level. (If you use a different length stick, then correct by using the conversion table.
3. Place a jar with some liquid in it on the outright stick. Raise or lower the stick until level.
4. Measure the number of inches (centimeters) the free end of the stick is off the ground.
5. The number of inches (centimeters) is the slope of the land in percent.
6. Repeat the above steps in several different areas to get an average slope of the land being investigated.



CONVERSION TABLE

Stick length (inches)	Distance the end of the stick is above the ground	Multiply by conversion factor	Slope %
100 in. (cm)	_____ in. (cm)	x 1	= _____
50 in. (cm)	_____ in. (cm)	x 2	= _____

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VII. DETERMINING POSSIBLE LAND USES

"Using the soil data you have collected, the slope measurements, and the land use data tables, determine a land classification and possible use(s) for your study site." Distribute Task F. (20 minutes)

TASK F (small groups)

DETERMINING POSSIBLE LAND USES

Man's great diversity of land uses requires different sets of criteria that analyze a variety of soil and land factors in different ways. These factors must be considered in determining the most appropriate land use for a given area. The most limiting soil factor will be the major influence in determining the best use of the land. See the Land Use Data Tables for definition of limiting soil factor.

Using the data from Tasks D and E and from the Land Use Data Tables, answer the following questions.

According to the Land Use Data Tables, this land could be used for:

1. Agriculture (list and explain why):

2. Occupancy land uses
   Roads and streets
   Building sites
   Septic tank filter fields
   Picnic and camp areas

I feel the best uses of this land would be: _____

_____

Why? _____

LAND USE DATA TABLES

AGRICULTURAL USES

Directions: Circle the item in each of the five columns below that best describes each of the five soil factors in the soil you studied. The most limiting soil factor will determine the best agricultural use of the land. A limiting soil factor can be defined as something that will restrict the use of land for desired activities. The most limiting factor indicates the most appropriate agricultural use.

SOIL FACTORS					Agricultural Uses
Slope (%)	*Erosion Hazard*	*Soil Depth*	*Drainage*	*Texture*	
0-3	None	Deep	Good	Loam or silt loam*	Farm crops—cultivation good soil mngmt. practices
3-20	Slight to moderate	Mod. deep	Somewhat poor	Sandy loam or silty clay	Farm crops—few to several special cultivation practices
20-30	Severe	Shallow	Poor	Sand or clay	Occasional cultivation, many special practices
0-2	None to slight	Deep	Good to poor	Stony	Pasture-woodland cultivation: no machinery can be used
30-90	Very severe	Deep to shallow	Good to poor	Sandy, loamy, clayey or rocky	Pasture, timber growing, woodland, wildlife, no cultivation machinery
all	None to extreme	Deep to shallow	Excessive to poor	Rockland, river wash, sand dunes	Wildlife, recreation

*Loam is a combination of sand, silt, and clay particles.

Occupancy land uses

Select the most limiting factor for each land use and record the overall limitation (slight, moderate or severe) on Task F.

Land Uses and Factors Affecting That Use	*Slight Limitation*	*Moderate Limitation*	*Severe Limitation*
Roads and Streets			
Slopes	0-12%	12-30%	Over 30%
Depth	Over 40 in.	20-40 in. (50.8-101.6 cm)	Less than 20 in.
Watertable	Over 20 in.	10-20 in. (25.4-50.8 cm)	Less than 10 in.
Building Sites			
Slopes	0-12%	12-20%	Over 20%
Depth	Over 40 in.	20-40 in. (50.8-101.6 cm)	Less than 20 in.
Watertable	Over 30 in.	20-30 in (50.8-76.2 cm)	Less than 20 in.
Septic Tank Filter Fields			
Slope	0-7%	7-12%	Over 12%
Depth	Over 6 ft.	4-6 ft. (121.9-182.9 cm)	Less than 4 in.
Watertable depth below trench	Over 4 ft.	2-4 ft. (61.0-121.9 cm)	Less than 2 ft.
Picnic and Camp Areas			
Slope	0-7%	7-15%	Over 15%
Stones	0-20%	20-50%	Over 50%
Watertable during season of use	Over 30 in.	20-30 in. (50.8-76.2 cm)	Less than 20 in.

Questions and Discussion

1. "What recommendations did you make on Task F?"
2. "How do you feel about the present use of this land?"
3. "How could man improve the use of this land?"
4. "What are some uses which could damage the land? What environmental precautions should be taken to minimize the damage?"
5. "How do the things we have done so far relate to making land use decisions?"
6. "How do social, economic and political factors affect the development and use of the land?"
7. "What are some long-range effects of land use decisions on our society?"

VIII. COMMUNICATING FEELINGS, AWARENESS, AND VALUES

TASK G (individuals or small groups)

In addition to the factors we have collected information about today, list others that influence the way land is used.

Factor	Who Is Involved	Influence On Land

Select one or two of the above factors and describe what you might do to become involved in determining how the land will be used in your backyard, community, county, etc.

Ask for responses from Task G and discuss.

IX. SUMMARY

1. "What did we find out about the environment in our study today?"

2. "How can we summarize our discussions and investigations?

3. "How are soil characteristics important in environmental management?"

4. You may want the participants to evaluate the session by writing how they felt about it.

X. SOME OBJECTIVES

Behavorial Outcome in Knowledge

1. As a result of this session each participant should be able to:

   a. Describe three ways in which the living organisms in the top part of the soil affect the soil

   b. Construct a soil micronomolith of an assigned soil profile, and determine and record texture, structure, pH, temperature, and color of each layer

   c. Write a description of a soil studied, using the words recorded about that soil on the micromonolith

   d. Demonstrate the ability to determine the best uses of the land in this area, using the data from the soil micromonolith and the land capability charts

   e. Describe three things that man does to determine the proper management of soil resource.

Behavorial Outcomes in Feelings, Awareness, Values, and Actions

1. As a result of this session, each participant should be able to:

   a. Describe how he or she feels about man's effect on this soil environment

   b. Describe how he or she feels about man's effect on the soil environment where they live

   c. Describe what he or she can do to improve the use of the soil and in communities.

XI. EQUIPMENT NEEDED (for a class of 30 people)

- 6 La Motte soil pH kits
- 30 micromonolith cards
- 6 tape measures
- 30 sets of lab sheets
- 3 sticks (50"/cm or 100"/cm long)
- 30 sets of task cards and data cards
- 3 staplers
- 1 box of staples
- 2 shovels
- 3 yardsticks (metersticks)
- 100 jelly cups and lids*
- 3 soil thermometers
- 2 #10 cans of water
- 30 hand lenses
- 3 baby food jars, half full of water

Samples of sand, silt, clay (optional)
Plant samples, drawings, or guides to use with soil pH plant relationship chart (optional)

The tasks and discussion topics in this lesson are designed so that many can be done individually or in combination, depending upon the facilitators objectives and time constraints.

It is suggested by the writers that continual plan revision be done by the people who use this plan.

*Other materials (baggies, plastic wrap, pill bottles, etc.) have been used satisfactorily.

TASK A

Write your own description of soil. Keep this description for reference later.

TASK B (small groups)

1. Predict what you will find in the top few inches (centimeters) of the area to be studied. List your predictions.

2. Select an area about 2 feet (61 cm) square on the ground and sift through the top 3 inches (7.6 cm), recording the evidence of plants and animals you observe. Replace the ground in as near original condition as possible.

Name or description of item in the soil	Quantity	Possible effect on soil

3. The terms litter, duff, and humus are used to describe organic matter at the top of the soil. From your study above, complete the following chart

Term and definition	Describe the feel	List the identifiable parts of plants and animals you found
Litter (identifiable dead things on surface)		
Duff (partially decomposed organic matter - compacted		
Humus (almost completely decomposed nonidentifiable organic matter)		

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TASK C

Using the information on the back of this task, and the available equipment, record your observations below. Make a micromonolith using the materials provided.

Sketch your soil profile, label the layers or horizons, and record the data.

PROFILE SKETCH

DATA

Air temperatures:
3 ft. (91.4 cm) above surface _____
Just along surface _____
Contents of layers above top soil (if existing):
Litter _____
Duff _____
Humus _____
Total depth of layer above top soil _____

Topsoil (a horizon):
Depth _____ in. (cm) to _____ in. (cm)
Color _____
Texture: Sandy _____ Loamy _____ Clayey _____
Structure: Columnar___ Blocky___ Platey___ Granular___
pH _____
Temperature _____ °F (°C)
Plant roots visible _____

Record below the same information for the other layers.

Describe type of rock in the bedrock (if present).

COLLECTING INFORMATION ABOUT SOIL CHARACTERISTICS

1. ***Soil layers*** (horizons). Mark where the soil changes color and general appearance. Many soils have three major layers or horizons: top soil, subsoil, and parent material. Because soil formation has many variables, you may find more or fewer layers.

2. ***Color***. Describe the color of each major layer, using your own descriptive terms. Moisten soil to get a more accurate color description.

3. ***Texture*** (how the soil feels). Determine the texture of each major layer. Testure is determined by the feel. Rub a moistened sample of soil between thumb and forefinger. Spit on sample to moisten, if water is not available.
   If it feels very gritty and not plastic– sandy
   If it feels smooth and slick, or somewhat gritty and sticky– loamy
   If it feels smooth, plastic, very sticky– clayey

4. ***Structure*** (how the soil is put together in geometric shapes). Determine the structure of each major layer. Carefully break apart a shovelful of soil from each layer and match its characteristics with one of these structure words: Blocky

   Columnar

   Granular

   Platey

5. ***Temperature***. Determine the temperature of each layer. Use the soil thermometer.

6. ***pH*** (acidity or alkalinity). Determine the pH of each major layer. Soil pH is an indication of how well certain plants can grow in the soil. Put a small sample of the soil to be tested in a porcelain dish. Do not touch the sample. Use just enough pH reagent to saturate the soil sample. Match the color of the pH reagent at the edge of the soil sample with pH color chart.

   Each person should ***construct a soil micromonolith*** (Task C). A micromonolith is a small model of a soil profile in which samples of each soil layer are attached to a card.

TASK D (individuals or small groups)

ANALYZING SOIL DATA

Using the soil data you collected and the information provided in the soil data tables on the other side of this Task, complete the following.

1. On the basis of soil depth, complete the following (refer to Table I).
   The potential of my soil for water storage is _____.
   Why? _____.

2. On the basis of color, complete the following (refer to Table II).

   a. The top soil, or A horizon:

      Amount of organic material _____.
      Erosion factor _____.
      Fertility _____.

   b. The drainage in the subsurface soil, or B horizon, is: _____
      _____.

3. On the basis of texture, complete the following (refer to Table III).

Layer or horizon	Water holding capacity	Looseness of soil
Topsoil A		
Subsoil B		

4. On the basis of structure, complete the following (refer to Table IV).

Layer or horizon	Penetration of Water	Drainage	Aeration
Topsoil A			
Subsoil B			

5. On the basis of pH ranges, complete the following (refer to Table V).

Some plants that could grow here according to the soil pH plant chart	Some plants actually observed growing here

   How well did the plants in the study area check out with the pH you measured?

   Describe in a short paragraph how you would set up an experiment to collect data and construct your own soil pH plant chart.

6. On the basis of the soil temperatures, complete the statement below (refer to Table VI): The plants on my soil have_____ growth taking place now. I predict that in 3 months the growth conditions of the soil, on the basis of soil temperature, will be _____.

7. Write a soil description about this soil using the words from the data you collected and recorded on the soil micromonolith card. Compare this description with the one you wrote at the beginning of the session.

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SOIL DATA TABLES

TABLE I. RELATIONSHIPS OF SOIL DEPTH TO PLANT GROWTH AND WATER STORAGE

Soil Depth	Water Storage
Deep Soil (over 42" or 1.1 m.)	Excellent water storage and plant growth
Mod. Deep Soil (20"-42" or 0.6-1.1 m.)	Good water storage and plant growth
Shallow Soil (20" or 0.6 m. and under)	Poor water storage and plant growth

TABLE II. SOME RELATIONSHIPS OF COLOR TO SOIL CONDITIONS

A. TOPSOIL (A HORIZON)

Condition	Color		
	Dark (dark grey brown to black)	Moderately dark (brown to yellow-brown)	Light (pale brown to yellow)
Amount of organic material	High	Medium	Low
Erosion factor	Low	Medium	High
Aeration	High	Medium	Low
Available Nitrogen	High	Medium	Low
Fertility	High	Medium	Low

B. SUBSURFACE SOIL (B HORIZON)

Subsurface soil color	Condition
Dull grey (if in low rainfall soils 0-20")	Water-logged soils, poor aeration
Yellow, red-brown, black (if in forest soils)	Well-drained soils
Mottled grey (if in humid soils)	Somewhat poorly to poorly drained soils

TABLE III. SOME EFFECTS OF TEXTURE ON SOIL CONDITIONS

Texture	Water holding capacity	Looseness of soil
Sandy	Poor	Good
Loamy	Good to excellent	Good
Clayey	High (water held too tightly for plant use)	Poor

TABLE IV. SOME EFFECTS OF STRUCTURE ON SOIL CONDITIONS

Structure	Penetration of water	Drainage	Aeration
Columnar	Good	Good	Good
Blocky	Good	Moderate	Moderate
Granular	Good	Best	Best
Platey	Moderate	Moderate	Moderate

TABLE V. RELATIONSHIPS OF SOIL pH TO PLANT SPECIES

3.5	4.5	6.5	7	8.5	14
(3.5 to 4.5 is too acid for many plants)		(Most plants do best here)		(8.5 to 14 is too alkaline for most plants)	

Some examples of soil pH plant indicators:

pH 4.0-5.0: Camellias, sweetbay, galax, white cedar, some ferns, mountain ash, pink ladyslipper, pines and spruces.

pH 5.0-6.0: Azaleas, blueberries, hemlocks, some pines, firs, holly, daphne, some spruce, oaks, birch, willow, chorteopsis, rhododendron, alder, apple, aster, chinquapin and juniper.

pH 6.0-7.0: Maple, hophornbeam, pansy, asters, peaches, sassafras, lettuce, pines, firs, ash, basswood elm, yellow poplar, scarlet oak, black oak, red oak, red cedar, and hickory.

pH 7.0-8.0: Mock orange, asparagus, sagebrush, oxalis, haw, baldcypress, blackberry, catalpa, and hackberry.

Note: These relationships may vary slightly in different environments.

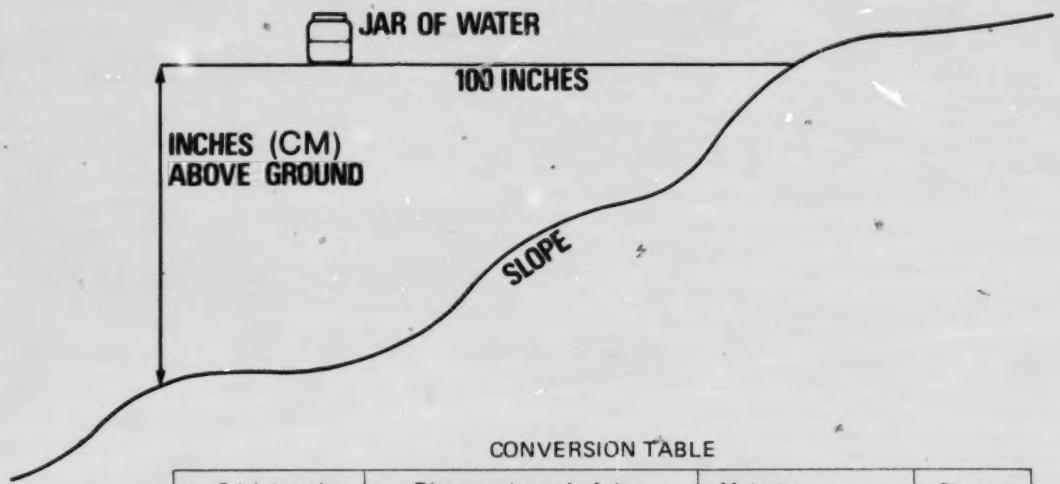
TABLE VI. SOME RELATIONSHIPS OF SOIL TEMPERATURE TO PLANT GROWTH

Soil temperature	Plant growth during growing season
Less than 40°F (4.4°C)	No growth, soil bacteria and fungi not very active
40°F – 65°F (4.4°C – 18.3°C)	Some growth
65°F – 70°F (18.3°C – 21.1°C)	Fastest growth
70°F – 85°F (21.1°C – 29.4°C)	Some growth
Above 85°F (29.4°C)	No growth

TASK E

MEASURING THE SLOPE OF THE LAND

1. Select a place that represents the average slope of the land being studied or take several measurements and average them.
2. Place one end of a 100-inch (100 cm) stick on the slope you want to measure. Hold stick so it is about level. If you use a different length stick, then correct by using the conversion table.
3. Place a jar with some liquid in it on the outright stick. Raise or lower the stick until level.
4. Measure the number of inches (centimeters) the free end of the stick is off the ground.
5. The number of inches (centimeters) is the slope of the land in percent.
6. Repeat the above steps in several different areas to get an average slope of the land being investigated.



CONVERSION TABLE

Stick length (inches)	Distance the end of the stick is above the ground	Mult. by conversion factor	Slope %
100 in. (cm)	_____ in. (cm)	x 1 =	_____
50 in. (cm)	_____ in. (cm)	x 2 =	_____

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TASK F (small groups)

DETERMINING POSSIBLE LAND USES

Man's great diversity of land uses requires different sets of criteria that analyze a variety of soil and land factors in different ways. These factors must be considered in determining the most appropriate land use for a given area. The most limiting soil factor will be the major influence in determining the best use of the land. See the Land Use Data Tables for definition of limiting soil factor.

Using the data from Tasks D and E and from the Land Use Data Tables, answer the following questions.

According to the Land Use Data Tables, this land could be used for:

1. Agriculture (list and explain why):

2. Occupancy land uses
   Roads and streets
   Building sites
   Septic tank filter fields
   Picnic and camp areas

I feel the best uses of this land would be: _____

_____

Why? _____

TASK G (individuals or small groups)

In addition to the factors we have collected information about today, list others that influence the way land is used.

Factor	Who Is Involved	Influence On Land

Select one or two of the above factors and describe what you might do to become involved in determining how the land will be used in your backyard, community, county, etc.

SOIL INVESTIGATION Task Card
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LAND USE DATA TABLES

AGRICULTURAL USES

Directions: Circle the item in each of the five columns below that best describes each of the five soil factors in the soil you studied. The most limiting soil factor will determine the best agricultural use of the land. A limiting soil factor can be defined as something that will restrict the use of land for desired activities. The most limiting factor indicates the most appropriate agricultural use.

SOIL FACTORS					Agricultural Uses
Slope (%)	*Erosion Hazard*	*Soil Depth*	*Drainage*	*Texture*	
0-3	None	Deep	Good	Loam or silt loam*	Farm crops—cultivation good soil mngmt. practices
3-20	Slight to moderate	Mod. deep	Somewhat poor	Sandy loam or silty clay	Farm crops—few to several special cultivation practices
20-30	Severe	Shallow	Poor	Sand or clay	Occasional cultivation, many special practices
0-2	None to slight	Deep	Good to poor	Stony	Pasture-woodland cultivation; no machinery can be used
30-90	Very severe	Deep to shallow	Good to poor	Sandy, loamy, clayey or rocky	Pasture, timber growing, woodland, wildlife, no cultivation machinery
all	None to extreme	Deep to shallow	Excessive to poor	Rockland, river wash, sand dunes	Wildlife, recreation

*Loam is a combination of sand, silt, and clay particles.

Occupancy land uses

Select the most limiting factor for each land use and record the overall limitation (slight, moderate or severe) on Task F.

Land Uses and Factors Affecting That Use	*Slight Limitation*	*Moderate Limitation*	*Severe Limitation*
Roads and Streets			
Slopes	0-12%	12-30%	Over 30%
Depth	Over 40 in.	20-40 in. (50.8-101.6 cm)	Less than 20 in.
Watertable	Over 20 in.	10-20 in. (25.4-50.8 cm)	Less than 10 in.
Building Sites			
Slopes	0-12%	12-20%	Over 20%
Depth	Over 40 in.	20-40 in. (50.8-101.6 cm)	Less than 20 in.
Watertable	Over 30 in.	20-30 in. (50.8-76.2 cm)	Less than 20 in.
Septic Tank Filter Fields			
Slope	0-7%	7-12%	Over 12%
Depth	Over 6 ft.	4-6 ft. (121.9-182.9 cm)	Less than 4 in.
Watertable depth below trench	Over 4 ft.	2-4 ft. (61.0-121.9 cm)	Less than 2 ft.
Picnic and Camp Areas			
Slope	0-7%	7-15%	Over 15%
Stones	0-20%	20-50%	Over 50%
Watertable during season of use	Over 30 in.	20-30 in. (50.8-76.2 cm)	Less than 20 in.

a lesson plan for

SOME WATER INVESTIGATIONS

Set the stage for this investigation by reviewing quickly what will take place in the allotted time. For example, "In this investigation, we will develop some skills in collecting and interpreting data about the water environment. We will then apply these data in discussing the role of water in the environment and our society."

Note to facilitator: Both the metric and English systems of measurement are included in the lesson plan. If it has not already been determined, you should discuss and decide with the group which system will be used.

I. OBSERVING THE WATER ENVIRONMENT

Distribute Task A.

"As you approach the water, record your observations on Task A." (10 minutes)

> TASK A (individuals or small groups)
>
> As you approach the water, observe and record your observations.
>
> Plants _____
>
> Animals _____
>
> Air _____
>
> Rocks _____
>
> Water _____
>
> Other _____

Questions and Discussion

1. "What are some things you noticed as you approached the water?"

II. OBSERVING AND COLLECTING AQUATIC LIFE

Questions and Discussion

1. "What do you notice about the water environment?"
2. "What are some factors that affect the lives of animals in water?"
3. "Where would you expect to find animals in a water environment?"
4. "What are some guidelines that we need to consider in collecting aquatic life so our investigation will cause the least impact on the environment?"

Pass out collecting equipment. Go on to Task B. (30 to 40 minutes)

> TASK B (individuals or groups)
>
> Part 1
>
> Using the collecting equipment (screens, jelly cups, etc.), collect as many types of aquatic animals as possible. Put them in the white dishpans for observation by the group. (Keep the pans in a cool place.) When you have finished, move on to Part 2 of the task. Try to identify the aquatic life found.

III. IDENTIFYING AND RECORDING AQUATIC ANIMALS

Have groups identify as many of the aquatic animals they found as possible, using the aquatic life drawings on back of Task B and in pond life books provided. (20 minutes)

Part 2

Using the "Golden Nature Guide Pond Life" books, or similar field manuals, and picture keys on the other side of this card, generally identify the specimens you found.

List or sketch the animals you found. Return animals to water as soon as you have finished.

Description of where found	Type (name or sketch)	How many	Common name

Questions and Discussion

1. "What animals did you find?" (You might compile a group list, preferably on a chart. Each person could record his own list.)
2. "Where did you find most of the specimens?"
3. "What other life would you expect to find in this stream?"
4. "What are some things we could do with this list of animals?"

IV. PREDICTING WATER CHARACTERISTICS FROM AQUATIC ANIMALS FOUND

Distribute Task C Cards. On the basis of the aquatic animals you found, and the tables in Task C, predict the temperature, pH, and O_2 count. (10 minutes)

TASK C (individuals)

On the basis of the aquatic animals you found, the tables in the Aquatic Data section below, and your observations, predict the following characteristics of this stream.

I predict that the:

Water temperature will be _____ because _____

Air temperature will be _____ because _____

pH will be _____ because _____

Dissolved O_2 count will be _____ because _____

I can see about _____ ft. into the water.

The color of the water is _____

Keep these predictions for future use.

AQUATIC DATA

Table I. pH Ranges That Support Aquatic Life

	MOST ACID					NEUTRAL					MOST ALKALINE		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Bacteria	1.0												13.0	
Plants (algae, rooted, etc.)						6.5						12.0		
Carp, suckers, catfish some insects						6.0			9.0					
Bass, crappie						6.5		8.5						
Snails, clams, mussels							7.0		9.0					
Largest variety of animals (trout, mayfly, stonefly, caddisfly)						6.5	7.5							

Table II. Dissolved Oxygen Requirements for Native Fish and Other Aquatic Life

Examples of Life	D. O. in parts per million or/milligrams per liter
Cold water organisms, including salmon and trout (below 68° F.)	
Spawning, growth and well being (caddisfly, stonefly, mayfly)	6 ppm and above
Warm water organisms (including game fish such as bass, crappie, cat fish and carp) (above 68° F.)	
Growth and well being (some caddis fly)	5 ppm and above

Table III. Temperature Ranges (Approximate) Required for Certain Organisms

Temperature (Fahrenheit)	Examples of life
Greater than 68° F. (20 °C) – warm water	Much plant life, many fish diseases Most bass, crappie, bluegill, carp, catfish, caddisfly
Middle range: 55 - 68° F. (12.8-20 °C)	Some plant life, some fish diseases Salmon, trout, stonefly, mayfly, caddisfly, water beetles
Low range: Less than 55° F. (12.8 °C) – cold	Trout, caddisfly, stonefly, mayfly

V. MEASURING AND RECORDING WATER CHARACTERISTICS TO TEST OUT PREDICTIONS

"One way to test the predictions is to use this (Hach Water O_2pH Testing Kit, or equivalent). Open the kit. The instructions are inside the lid. There are lots of jobs to be done in testing (clipping, squirting, swirling, dipping, counting, reading, etc.), so make sure everyone in the group has a job to do."

Pass out Task D (and Data Card on the reverse side). Have group transfer their predictions from Task C to Task D and record the test measurements beside the predictions for comparison.

Each group of three to five people takes a kit, and spreads out along the edge of the water.

Do not demonstrate the use of the kit. Let the participants read the instructions and learn to use the kit as they collect the data. You should check among the groups as they work to make sure they use the right bottles, chemicals, etc. (20 minutes)

Questions and Discussion

1. "How did the test results compare to the predictions?"

2. "Under what conditions might we expect to get different results than we did today?"

3. "What can we say about the quality of the water in this stream so far?"

4. "What else would we need to know to decide whether or not to drink this water?" (Coliform bacteria count)

TASK D (groups of 3-5)

Make Sure Everyone in Your Group Gets Involved in the Testing.

1. Using the water test kit, determine the water and air temperature, dissolved oxygen count, and pH of the stream or pond.
   Record the data below, using predictions from Task C.

   Name of Stream, Pond or Lake:

Location of water sample (edge or middle of stream bank of pond, etc.)	Time Taken	Temperature (°F or °C)				pH		Usable Oxygen (ppm) (mg/liter)	
		Water		Air					
		My pred.	Actual test	My pred.	Actual test	My pred.	Actual test	My pred.	Actual test

2. Water Productivity and Color
   On the basis of the color you recorded in Task C and Table I (See Data Card reverse side), what can you say about this water? _____

3. Light Pentration (pond or lake)
   My estimate of how far I could see into water (from Task C) is _____ft. (or meters).
   Transparency of lake and pond waters can be roughly determined by the use of a white and black plate (called a secchi disk), which is lowered on a line until it can no longer be seen. It is approximately 8 inches in diameter, painted white and black in alternative quadrants. Very little sunlight pentrates below the point at which the disk disappears.

   Lower the Secchi disk into the water until it can no longer be seen. Measure depth from surface of the water to the disk and record _____ft. (or meters).
   On the basis of the depth of the Secchi disk and Table II, what can you say about the water?

4. Temperature Layering (pond or lake)
   On the basis of the temperatures you recorded for your pond, the season of year, and the information in Table III, describe what you think is happening in the water now.

VI. MEASURING WATER VOLUMES FOR STREAM, POND, OR LAKE

(For a stream, use Part 1; for a pond or lake, use Part 2.)

Part 1. Stream Measurements

Questions and Discussion

1. "How many people do you think could live off the water in this stream (domestic water use only)?
2. "What measurements do we need to know in order to determine the amount of water in this stream?" Discuss how to make different measurements. Work Task E, Part 1.

Questions and Discussion

1. "How many people could live for 1 day (domestic use only) off the water in this stream?"
2. "How did your prediction compare with your measurement?"
3. "What would happen to this environment if we piped all the water at this point to a community?"
4. "If we were goint to use some of this water, how much should be left to flow downstream? Why?"
5. "What might affect the amount of water in this stream?"
6. "How important is this stream to a community? To the environment here?"

Part 2. Pond or Lake Measurements

Questions and Discussion

1. "How many people do you think could live off the water in this pond or lake?" (domestic water use only)
2. "What measurements do we need to know in order to determine the volume?" Work Task E, Part 2.

Questions and Discussion

1. "How many people could live for one day (domestic use only) off the water in this pond?"
2. "How did your prediction compare with your computations?"
3. "What might affect the amount of water in this pond?"
4. "What would happen to this aquatic environment if we drained it?"
5. "If we were going to use some of this water, how much should be left to minimize damage to the pond environment?"
6. "How important is this pond to the environment?"

TASK E (in groups)

Part 1. For Stream

Instructions for collecting and recording streamflow measurements.

(For metric application, substitute meters for feet and liters for gallons.)

1. Measure and mark a 100-foot distance along a straight section of your stream. If you can't find a 100' section, use 25' or 50'. Throw a stick (5 or 6 inches long, or 12.7 or 15.2 cm long) in the water above the upstream marker. Record the number of seconds it takes to float downstream between the markers. Record below. Now divide the 100-foot distance by the total seconds it took the stick to float between the stakes. Do this three times and use the average time.

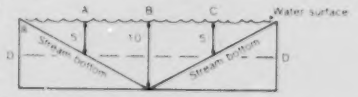
1st measurement - 100 ft ÷ _____ = _____ ft. per second.
(distance) (total seconds to float 100 ft.) (number of feet stick floated each second)

2nd measurement 100 ft ÷ _____ = _____ ft. per second.
3rd measurement 100 ft ÷ _____ = _____ ft. per second.
Total _____ ÷ 3 = _____
(ft. per second) (ft. per second average)

2. Find the average width of your section of the stream. Measure the width of the stream at three places within the 100-foot area, then divide the total by three to get the average width of the stream.
First measurement _____ ft.
Second measurement _____ ft.
Third measurement _____ ft.
Total _____ ft. ÷ 3 = _____ ft. (average width)

3. Find the average depth of your section of the stream. Measure the depth of the stream in three places across the stream in a straight line, then divide the total by four to get the average depth of the stream.
First measurement _____ ft.
Second measurement _____ ft.
Third measurement _____ ft.
Total _____ ft. ÷ 4 = _____ ft. (average depth)

NOTE: The reason you take three depth measurements then divide by four is to take into account the shallow areas of the stream. It can be explained by the following example of a drawing of a stream cross section. If depth in three places in A(3'), B(10') and C(5'), (total 20'), find an average by dividing by three. 20' ÷ 3 = 6 2/3'. Now look at the area or average depth (D), which is 5'. Take total of depths and divide by four. 20' ÷ 4 = 5', the correct average depth.



4. Find the cubic feet of water per second. Multiply the average width, average depth, and the number of feet the stick floated each second. (A cubic foot is water in a container 1 foot wide, 1 foot high, and 1 foot long, or 7.48 gallons. A cubic meter of water is the amount in a container 1 meter wide, 1 meter high, and 1 meter long, or 1,000 liters.)

_____ ft. X _____ ft. X _____ = _____
Average width | Average depth | Number of feet per second | Cubic feet of water flowing per second

5. The average person uses about 200 gallons (757 liters) of water a day for home use. (This does not reflect each person's share of water used for public services and industrial and commercial uses.)* In order to find out how many people could get their water needs for 1 day from this stream, complete the following calculations.

_____ X _____ = _____
Stream flow in cu. ft. per second | Gallons in 1 cu. ft. of water | Gallons of water per second

_____ X _____ = _____
Gallons per second | Seconds in minute | Gallons of water per minute

_____ X _____ = _____ ÷ *200 Gals. = _____
Gallons of water per minute | Number of minutes in a day | Total gallons water per day | (Amount of water one person uses per day) | Total number of people who could get daily waters needs from this stream

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TASK E (in groups)

Part 2. For Pond or Lake

Instructions for collecting and recording volumes of water in a pond or lake.

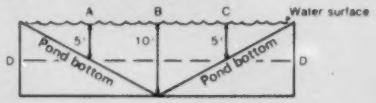
(For metric application, substitute meters for feet and liters for gallons.)

1. Find the average diameter (distance across) of the pond. Measure the length and width of the pond. You may have to take several length and width measurements and get average of them.

   Pond width _____ ft.
   Pond length _____ ft.
   Total _____ ft. ÷ 2= ___ ft. (average diameter)
   Average diameter _____ ft. x 3.14 ( ) ÷ 4= ____ sq. ft. surface.
   (area of pond)

2. Find the average depth of the pond or lake. Measure the depth in three places along a line (transect) across the pond, as near the middle as possible. Add these depths and divide by four (see explanation below) to get the average depth. (If additional accuracy is desired, repeat this process along additional transects and average results.)
   First measurement _____ ft.
   Second measurement _____ ft.
   Third measurement _____ ft.
   Total _____ ft. ÷ 4 = _____ ft. (average depth)

   NOTE: The reason you take three depth measurements then divide by four is to take into account the shallow areas of the pond. It can be explained by the following example of a drawing of a pond cross-section. If depth in three places is A(5′), B(10′) and C(5′), (total 20′), find an average by dividing by three: 20′ ÷ 3 = 6 2/3′. Now look at the area or average depth (D) which is 5′. Take total of depths and divide by four: 20′ ÷ 4 = 5′, the correct average depth.



3. Formula for computing number of gallons of water in pond.
   a. _____ X _____ = _____ cu. ft.
   Area of pond Average depth Volume in cu. ft.
   b. _____ cu. ft. X 7.48 = _____
   Volume in cu. ft. Number of gals. water in pond

   (A cubic foot of water is the water in a container 1 foot wide, 1 foot high, and 1 foot long, 7.48 gallons. A cubic meter of water is the amount in a container 1 meter wide, 1 meter high and 1 meter long, or 1,000 liters.)

4. Formula for computing the volume using acre feet of water. (No meter equivalent included)
   a. (Surface) _____ X _____ = _____
   Area of pond in feet Average depth in feet Volume cu. ft.

   b. _____ ÷ 43,560 = _____ acre feet of water.
   Volume cu. ft. (sq. ft. in an acre

   c. _____ X 395,900 = _____
   Acre feet Gal./acre foot Number of gallons in pond

5. The average person uses about 200 gallons (757 liters) of water a day for home use. (This does not reflect each person's share of water used for public services and industrial and commercial uses.)* In order to find out how many people could get their water needs for 1 day from this pond, complete the following calculations.

   _____ ÷ _____ = _____
   Gallons of water in the pond | Amount of water one person uses per day | Total number of people who could get daily water needs from this pond

*U.S. Office of Education

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VII. DETERMINING WATERSHED BOUNDARIES

Distribute Task F and a map of the area in which you have been working.

TASK F (small groups)

Describe what you think a watershed is. _____

_____

_____

_____

_____

Find your location on this stream (pond, lake) on the map.
Where does the water come from? _____
Where does it go? _____
Draw lines around the boundaries of our watershed. We are in the _____ watershed.

_____

What activities in this watershed might change the characteristics of this water?

Activity	Ways the activity might change the characteristics of the water

Have participants get into small groups and write a description of what they think a watershed is. Have groups share their definitions with the other groups.

Finish Task F. (10 minutes)

Questions and Discussion

1. "What activities did you list and how did you think they would change the water characteristics?"

2. "Are any of these evident here?"

3. "How would we find out more about this watershed?"

VII. COMMUNICATING FEELINGS, AWARENESS, AND VALUES

Have participants complete Task G. (10 minutes)

TASK G (individuals or small groups)

In addition to the factors we have collected information about today, list others that influence the way water is used.

Factor	Who Is Involved	Influence on Water

Select one or two of the above factors and describe what you might do to become involved in determining how the water will be used in your home, community, county, etc.

Ask for responses from Task G and discuss.

VIII. SUMMARY

1. "What did we find out about water from our investigations today?"
2. "How can we summarize our discussions and investigations?"
3. "What are some methods and processes we used in our investigations in this session?" (May be useful for first field sessions to identify processes used in the investigation)
4. You may want the participants to evaluate the session by writing how they felt about the session.

IX. SOME OBJECTIVES

Behavioral Outcomes in Knowledge

1. As a result of these activities, each participant should be able to:

   a. Identify the boundaries of the stream (pond or lake) watershed on the map provided

   b. Predict the pH, temperature, and dissolved oxygen count of the stream or pond, using the list of aquatic animals found

   c. Demonstrate the ability to test out the above predictions using the water testing kit

   d. Measure the cubic feet of water per second flowing in the stream, or in the pond, and determine what size community could live off the water measured

   e. Describe three ways this stream or pond is important to the surrounding environment.

Behavioral Outcomes in Feelings, Awareness, Values, and Action

1. As a result of these activities, each participant should be able to:

   a. Describe in writing how he or she feels about man's effect on the aquatic environment at this site

   b. Describe at least one action he or she can take in everyday life to help improve the way water is managed in the –
      Home
      Community
      Consumer habits

   c. Describe the benefits of each of the above actions

   d. Describe the implications of water use and management in our society.

X. EQUIPMENT NEEDED (for a class of 30 people)

- 4 Water testing kits (Hach Co. or equivalent)
- 4 Thermometers
- 4 White dishpans
- 30 Sets of lab sheets
  Task cards
  Data cards
- 1 Secchi disk
- 30 Jelly cups, baby food jars, etc.
- 30 Hand lenses
- 15 Pond Life books (Golden Nature Guides)
- 30 Maps of the area
- 1 50-foot or 100-foot tape
- 4 Screens
- Markers
- Chart paper

The tasks and discussion topics in this lesson are designed so that many can be done individually or in combination, depending upon the facilitators' objectives and time constraints.

It is suggested by the writers that continual plan revision be done by the people who use this plan.

TASK A (individuals or small groups)

As you approach the water, observe and record your observations.

Plants _____

Animals _____

Air _____

Rocks _____

Water _____

Other _____

TASK B (individuals or groups)

Part 1

Using the collecting equipment (screens, jelly cups, etc.), collect as many types of aquatic animals as possible. Put them in the white dishpans for observation by the group. (Keep the pans in a cool place.) When you have finished, move on to Part 2 of the task. Try to identify the aquatic life found.

Part 2

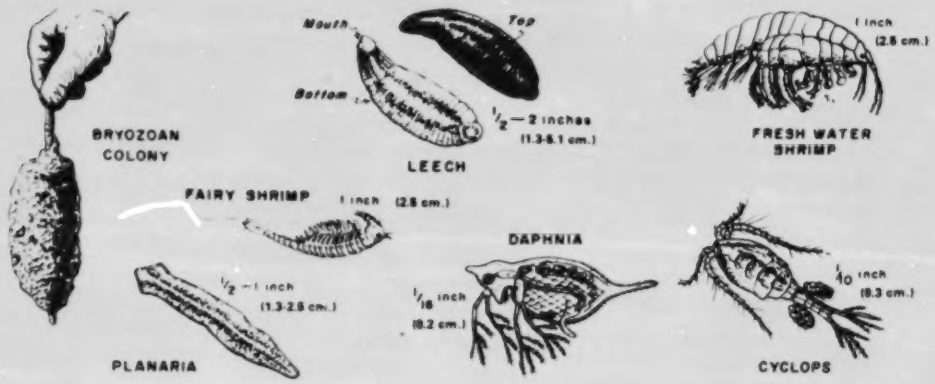
Using the "Golden Nature Guide Pond Life" books, or similar field manuals, and picture keys on the other side of this card, generally identify the specimens you found.

List or sketch the animals you found. Return animals to water as soon as you have finished.

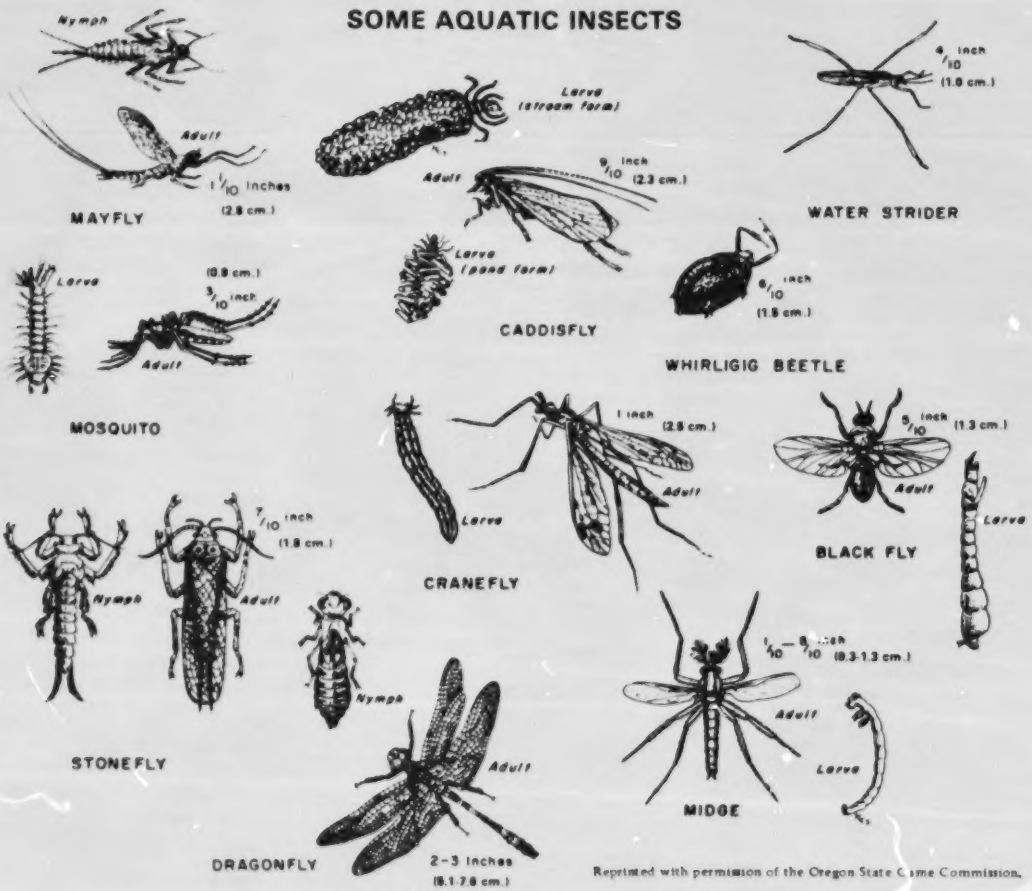
Description of where found	Type (name or sketch)	How many	Common name

WATER INVESTIGATION Task Card
Forest Service-USDA

SOME SUB-SURFACE FRESH WATER ORGANISMS



SOME AQUATIC INSECTS



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TASK C (individuals)

On the basis of the aquatic animals you found, the tables in the Aquatic Data section below, and your observations, predict the following characteristics of this stream.

I predict that the:

Water temperature will be _____ because _____

Air temperature will be _____ because _____

pH will be _____ because _____

Dissolved O_2 count will be _____ because _____

I can see about _____ ft. into the water.

The color of the water is _____.

Keep these predictions for future use.

AQUATIC DATA

Table I. pH Ranges That Support Aquatic Life

MOST ACID					NEUTRAL						MOST ALKALINE		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Bacteria 1.0												13.0	
Plants (algae, rooted, etc.)					6.5						12.0		
Carp, suckers, catfish some insects					6.0			9.0					
Bass, crappie					6.5		8.5						
Snails, clams, mussels						7.0		9.0					
Largest variety of animals (trout, mayfly, stonefly, caddisfly)					6.5	7.5							

Table II. Dissolved Oxygen Requirements for Native Fish and Other Aquatic Life

Examples of Life	D. O. in parts per million or/milligrams per liter
Cold-water organisms, including salmon and trout (below 68° F.)	
Spawning, growth and well-being (caddisfly, stonefly, mayfly)	6 ppm and above
Warm-water organisms (including game fish such as bass, crappie, cat fish and carp) (above 68° F.)	
Growth and well-being (some caddis fly)	5 ppm and above

Table III. Temperature Ranges (Approximate) Required for Certain Organisms

Temperature (Fahrenheit)	Examples of life
Greater than 68° F. (20 °C)– warm water	Much plant life, many fish diseases Most bass, crappie, bluegill, carp, catfish, caddisfly
Middle range: 55 - 68° F. (12.8-20 °C)	Some plant life, some fish diseases Salmon, trout, stonefly, mayfly, caddisfly, water beetles
Low range: Less than 55° F. (12.8 °C) – cold	Trout, caddisfly, stonefly, mayfly

WATER INVESTIGATION Task Card
Forest Service-USDA

TASK D (groups of 3-5)

Make Sure Everyone in Your Group Gets Involved in the Testing.

1. Using the water test kit, determine the water and air temperature, dissolved oxygen count, and pH of the stream or pond.
   Record the data below, using predictions from Task C.

   Name of Stream, Pond or Lake:

Location of water sample (edge or middle of stream bank of pond, etc.)	Time Taken	Temperature (°F or °C)				pH		Usable Oxygen (ppm) (mg/liter)	
		Water		Air					
		My pred.	Actual test	My pred.	Actual test	My pred.	Actual test	My pred.	Actual test

2. Water Productivity and Color
   On the basis of the color you recorded in Task C and Table I (See Data Card reverse side), what can you say about this water? _____

3. Light Pentration (pond or lake)
   My estimate of how far I could see into water (from Task C) is _____ft. (or meters).
   Transparency of lake and pond waters can be roughly determined by the use of a white and black plate (called a secchi disk), which is lowered on a line until it can no longer be seen. It is approximately 8 inches in diameter, painted white and black in alternative quadrants. Very little sunlight pentrates below the point at which the disk disappears.

   Lower the Secchi disk into the water until it can no longer be seen. Measure depth from surface of the water to the disk and record _____ ft. (or meters).
   On the basis of the depth of the Secchi disk and Table II, what can you say about the water?

4. Temperature Layering (pond or lake)
   On the basis of the temperatures you recorded for your pond, the season of year, and the information in Table III, describe what you think is happening in the water now.

WATER INVESTIGATION Task Card
Forest Service-USDA

Table I. Relationships of water color to productivity

The quantity of life that may be present in any given body of water at any given time is often referred to as the "productivity." A water of low productivity is a poor water, biologically speaking, but is a clean water and desirable as a water supply or for recreational use. A productive water may be either a nuisance to man or it may be highly desirable. Foul odors and weed-chocked waterways are usually branded a nuisance; however, bumper crops of bass, catfish or sunfish may be the result and are highly desirable. .

Color of Water	Probable Cause	Fish Food Productivity
Clear	Absence of algae and microorganisms	Low
Greenish Hue	Blue green algae	Moderate
Yellow to Yellow-Brown	Diatoms (microscopic, one-celled algae)	Moderately High
Red	Micro-crustaceans	High
Dark Brown	Peat, Humus	Low
GEOLOGICAL FACTORS HAVING BEARING ON COLOR		
In limestone geology-Green	Abundant Calcium	Moderate
In volcanic geology-Yellow-Green Red	Abundant Sulfur Abundant Iron	Low Moderate

Table II. Relationship of Water Clarity to Fish Food Production and Watershed Condition

Depth you can see into water (secchi disk reading)	Interpretations of Depth Readings		
	Fish Food Production (If reasons for degree of clarity are biological (algae, etc.))	Condition of Watershed above Water Readings (If reasons for degree of clarity are physical (soil siltation, etc.))	Possibility of Dissolved Minerals
0-6" (0-15.2 cm)	Most productive waters for fish food Maximum oxygen from photosynthesis (greatest) (diurnal variation) Maximum algae growth	Poor condition due to soil runoff, slides, etc.	Most
↓	↓	↓	↓
+ 24" (+ 61.0 cm)	Least productive for fish food Minimum oxygen from photosynthesis (least diurnal variation) Minimum algae growth	May indicate better condition because of vegetation cover - more stable soil, etc.	Least

Table III. Temperature Layering in Ponds--Lakes

In summer, the surface water absorbs the sun's heat and warms faster than the water below. The warmed water is lighter than the cold water, so it floats on the cool layers. By midsummer there are three distinct layers.

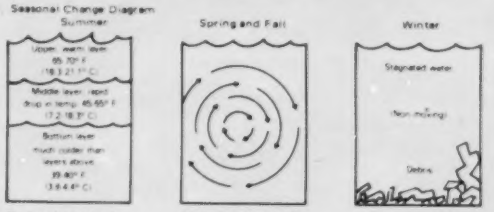
During the summer, mixing or circulation is prevented by these stratified layers of water which act as a barrier.

The upper layer of water cools in autumn until it approaches the temperature of the water in the middle and lower layers. Aided by winds, the surface water sinks causing circulation from top to bottom.

In winter, the cold surface water continues to sink and the water becomes stagnated, photosynthesis slows, and oxygen levels drop.

In the spring, aided by winds, another circulation and mixing occurs, called the "Spring Overturn."

1. Seasonal Change Diagram

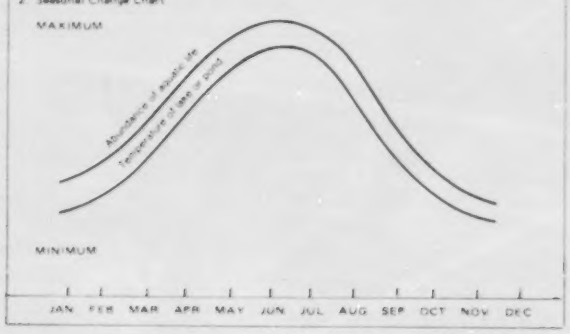


During the summer, fish and aquatic life are most active.

During spring and fall overturns, the temperature of the water is equalized throughout the lake. Fishes and other animals are more active than in winter, but less active than in summer.

Activity is greatly reduced during the winter. Many animals hibernate in the mud or debris at the bottom.

2. Seasonal Change Chart



TASK E (in groups)

Part 1. For Stream

Instructions for collecting and recording streamflow measurements.

(For metric application, substitute meters for feet and liters for gallons.)

1. Measure and mark a 100-foot distance along a straight section of your stream. If you can't find a 100' section, use 25' or 50'. Throw a stick (5 or 6 inches long; or 12.7 or 15.2 cm long) in the water above the upstream marker. Record the number of seconds it takes to float downstream between the markers. Record below. Now divide the 100-foot distance by the total seconds it took the stick to float between the stakes. Do this three times and use the average time.

1st measurement 100 ft (distance) ÷ _____ (total seconds to float 100 ft.) = _____ (number of feet stick floated each second) ft. per second.

2nd measurement 100 ft + _____ = _____ ft. per second

3rd measurement 100 ft + _____ = _____ ft. per second.

Total _____ (ft. per second) ÷ 3 = _____ (ft. per second average)

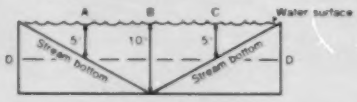
2. Find the average width of your section of the stream: Measure the width of the stream at three places within the 100-foot area, then divide the total by three to get the average width of the stream.

First measurement _____ ft.
Second measurement _____ ft.
Third measurement _____ ft.
Total _____ ft. ÷ 3 = _____ ft. (average width)

3. Find the average depth of your section of the stream: Measure the depth of the stream in three places across the stream in a straight line, then divide the total by four to get the average depth of the stream.

First measurement _____ ft.
Second measurement _____ ft.
Third measurement ft.
Total _____ ft. ÷ 4 = _____ ft. (average depth)

NOTE: The reason you take three depth measurements then divide by four is to take into account the shallow areas of the stream. It can be explained by the following example of a drawing of a stream cross-section. If depth in three places in A(3'), B(10') and C(5'), (total 20'), find an average by dividing by three, 20' ÷ 3 = 6 2/3'. Now look at the area or average depth (D), which is 5'. Take total of depths and divide by four: 20' ÷ 4 = 5', the correct average depth.



4. Find the cubic feet of water per second: Multiply the average width, average depth, and the number of feet the stick floated each second. (A cubic foot is water in a container 1 foot wide, 1 foot high, and 1 foot long, or 7.48 gallons. A cubic meter of water is the amount in a container 1 meter wide, 1 meter high, and 1 meter long, or 1,000 liters.)

_____ ft. (Average width) X _____ ft. (Average depth) X _____ (Number of feet per second) = _____ (Cubic feet of water flowing per second)

5. The average person uses about 200 gallons (757 liters) of water a day for home use. (This does not reflect each person's share of water used for public services and industrial and commercial uses.)* In order to find out how many people could get their water needs for 1 day from this stream, complete the following calculations.

_____ (Stream flow in cu. ft. per second) X _____ (Gallons in 1 cu. ft. of water) = _____ (Gallons of water per second)

_____ (Gallons per second) X _____ (Seconds in minute) = _____ (Gallons of water per minute)

_____ (Gallons of water per minute) X _____ (Number of minutes in a day) = _____ (Total gallons water per day) ÷ *200 Gals. (Amount of water one person uses per day) = _____ (Total number of people who could get daily waters needs from this stream)

*U.S. Office of Education

WATER INVESTIGATION Task Card
Forest Service-USDA

TASK E (in groups)

Part 2. For Pond or Lak

Instructions for collecting and recording volumes of water in a pond or lake.

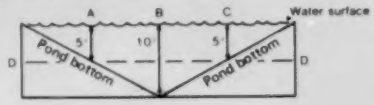
(For metric application, substitute meters for feet and liters for gallons.)

1. Find the average diameter (distance across) of the pond. Measure the length and width of the pond. You may have to take several length and width measurements and get average of them.

Pond width _____ ft.
Pond length _____ ft.
Total _____ ft. ÷ 2= ___ ft. (average diameter)
Average diameter _____ ft. x 3.14 ( ) ÷ 4= ____ sq. ft. surface.
(area of pond)

2. Find the average depth of the pond or lake. Measure the depth in three places along a line (transect) across the pond, as near the middle as possible. Add these depths and divide by four (see explanation below) to get the average depth. (If additional accuracy is desired, repeat this process along additional transects and average results.)
First measurement _____ ft.
Second measurement _____ ft.
Third measurement _____ ft.
Total _____ ft. ÷ 4 = _____ ft. (average depth)

NOTE: The reason you take three depth measurements then divide by four is to take into account the shallow areas of the pond. It can be explained by the following example of a drawing of a pond cross-section. If depth in three places is A(5'), B(10') and C(5'), (total 20'), find an average by dividing by three: 20' ÷ 3 = ε 2/3'. Now look at the area or average depth (D) which is 5'. Take total of depths and divide by four: 20' ÷ 4 = 5', the correct average depth.



3. Formula for computing number of gallons of water in pond.
a. _____ X _____ = _____ cu. ft.
Area of pond Average depth Volume in cu. ft.
b. _____ cu. ft. X 7.48 = _____
Volume in cu. ft. Number of gals. water in pond

(A cubic foot of water is the water in a container 1 foot wide, 1 foot high, and 1 foot long, 7.48 gallons. A cubic meter of water is the amount in a container 1 meter wide, 1 meter high and 1 meter long, or 1,000 liters.)

4. Formula for computing the volume using acre feet of water. (No meter equivalent included)
a. (Surface) _____ X _____ = _____
Area of pond in feet Average depth in feet Volume cu. ft.

b. _____ ÷ 43,560 = _____ acre feet of water.
Volume cu. ft. (sq. ft. in an acre

c. _____ X 395,900 = _____
Acre feet Gal./acre foot Number of gallons in pond

5. The average person uses about 200 gallons (757 liters) of water a day for home use. (This does not reflect each person's share of water used for public services and industrial and commercial uses.)* In order to find out how many people could get their water needs for 1 day from this pond, complete the following calculations.

_____ ÷ _____ = _____
Gallons of water in the pond | Amount of water one person uses per day | Total number of people who could get daily water needs from this pond

*U.S. Office of Education

TASK F (small groups)

Describe what you think a watershed is. _____

_____

_____

_____

_____

Find your location on this stream (pond, lake) on the map.
Where does the water come from? _____
Where does it go? _____
Draw lines around the boundaries of our watershed. We are in the _____ watershed.

_____

What activities in this watershed might change the characteristics of this water?

Activity	Ways the activity might change the characteristics of the water

WATER INVESTIGATION Task Card
Forest Service-USDA

TASK G (individuals or small groups)

In addition to the factors we have collected information about today, list others that influence the way water is used.

Factor	Who Is Involved	Influence on Water

Select one or two of the above factors and describe what you might do to become involved in determining how the water will be used in your home, community, county, etc.

a lesson plan for

SOME FOREST INVESTIGATIONS

Set the stage for this investigation by reviewing quickly what will take place in the allotted time. For example, "In this session we will develop some skills in collecting, recording, and interpreting data about the forest, and then communicate these interpretations using different methods and processes."

Note to facilitator: Both the metric and English systems of measurement are included in the lesson plan. If it has not already been determined, you should discuss and decide with the group which system will be used.

I. OBSERVING AND INFERRING WITH CROSS SECTIONS.

Distribute cross sections of trees 4"–6" (10–15 cm.) in diameter that show a variety of growth patterns and influences (fire, insects, etc.).

Have people spend a few minutes looking at the cross sections (5 minutes).

Questions and Discussions

1. "What are some of the things you noticed about the cross section?" List on board.
2. Point to two or three items from the list that deal with growth characteristics and rings (varying widths of growth rings, center not in the middle, etc.).
   "What are some possible reasons for _____?" Select some observations.
3. "In general, what could growth rings tell us about a group of trees?" (competition, climate, temperature)
4. Pass out Tasks A and B. "This is what we just did and here is the task card for your reference later."
   Refer to the information on Task A about tree growth rings.

TASK A (work in small groups)

Write down some things you notice about the cross section.

TASK B (work in small groups)

Select three observations about the cross sections from the group list.
List possible reasons for these observations.
List ways you could set up an investigation to find out more about your observations and inferences.

Observation (What you noticed)	Inferences (Possible reasons for this)	Investigations (How we could find out)
1		
2		
3		

Tree Rings Information

The current year's growth is the ring next to the cambium layer just inside the bark. The rapid spring growth is a lighter color that the growth made in the summer, so one light and one dark ring makes one year's growth. It is easier to see and count the summer wood or dark rings to determine the age of a stump or log of a tree when it was cut.

These rings are easily counted on the stumps of cut trees.

How old was this tree when it was cut? _____ The dark rings are summer wood and the light rings are spring wood. One light and one dark ring makes one year's growth.

Investigating Your Environment Series
Forest Service, United States Department of Agriculture
Revised 1978

II. COLLECTING AND INTERPRETING DATA ABOUT TREE GROWTH RATES AND COMPETITION

Task C (with tree cores) requires preparation by the facilitator before the session.

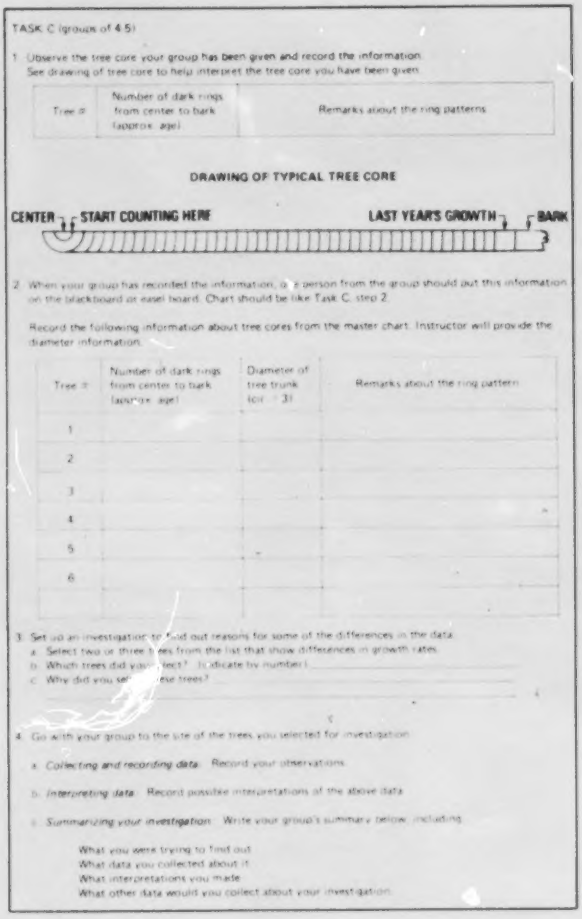
A tree stand should be selected for study, four to five trees tagged, numbered, and bored, and their diameters taken. Trees to be selected should show effects of environmental conditions—injury, overcrowding, lack of sunlight, etc. The tagged and numbered trees should be bored with an increment borer by the facilitator ahead of time. Cores should be numbered corresponding to numbers on trees. Taping tree cores to cardboard with see-through scotch tape or in plastic straws will help keep them longer if liquid resin is not available. In any event, keep the numbered cores and trees to use again. This eliminates the necessity of reboring the trees.

You may be able to find and use stumps of trees that grow under a variety of competititon influences, instead of using tree cores.

Steps 1–3 in Task C are all planning steps in setting up an investigation and should be done away from the study trees.

Questions and Discussion

1. "Observe the tree core that your group has been given and record the information in step 1 of Task C." Pass out hand lenses, pencils, the numbered tree cores taped to cardboard, and Task C. (10 minutes)



TASK C (groups of 4-5)

1. Observe the tree core your group has been given and record the information.
See drawing of tree core to help interpret the tree core you have been given.

Tree #	Number of dark rings from center to bark (approx. age)	Remarks about the ring patterns

DRAWING OF TYPICAL TREE CORE

CENTER — START COUNTING HERE — LAST YEAR'S GROWTH — BARK

2. When your group has recorded the information, a person from the group should put this information on the blackboard or easel board. Chart should be like Task C, step 2.

Record the following information about tree cores from the master chart. Instructor will provide the diameter information.

Tree #	Number of dark rings from center to bark (approx. age)	Diameter of tree trunk (or ÷ 3)	Remarks about the ring pattern
1			
2			
3			
4			
5			
6			

3. Set up an investigation to find out reasons for some of the differences in the data.
a. Select two or three trees from the list that show differences in growth rates.
b. Which trees did you select? (Indicate by number.) _____
c. Why did you select these trees? _____

4. Go with your group to the site of the trees you selected for investigation.

a. *Collecting and recording data*: Record your observations.

b. *Interpreting data*: Record possible interpretations of the above data.

c. *Summarizing your investigation*: Write your group's summary below, including:

What you were trying to find out
What data you collected about it
What interpretations you made
What other data would you collect about your investigation

2. Have each group tell you the information for the number of dark rings from center to bark and remarks about the ring pattern while you record on the large chart (see Task C, step 2). "What does this tell us about the trees these cores came from?"

3. Now put the diameters on the large chart and have everyone record them on Task C, step 2. Ask, "Now what does this added information tell us?"

4. "Go on to Task C, step 3. Pick out two or three trees from the chart that show differences in growth and set up an investigation to find out why there are differences."

5. Have the groups take Task C to the area where the trees are tagged and numbered. Have them spend 10–15 minutes doing the investigation and completing Task C, step 4.

6. (Outdoors) When all groups are finished, ask for a 2–3 minute summary from each group. "What did you find out?"

7. "What are some of the major factors that you think are affecting the growth of this forest?"

8. "What does the information tell us about the past events of this environment?"

III. OBSERVING EVIDENCE OF CHANGE

Pass out Task D.

Questions and Discussion

1. "What evidence of change (natural and manmade) might there be in this environment?"

2. "Spend the next 20 minutes looking for evidences of change and recording them on Task D." Pass out Task D.

TASK D

Look for evidence of change (natural and manmade) in the environment.
Record and fill out other columns.

Evidence of changes in the environment	What might have caused them?	Effect on the environment

Questions and Discussion

1. "What evidences did you find?" Have group develop a total list. Record on chart in front of total group, if possible.

2. "What could we do with this list?" This is a key question.

3. "Get into groups and put the whole list into a sequence." (Optional)

IV. OBSERVING AND RECORDING THINGS ABOUT A ROTTEN LOG OR STUMP

Move the group to a rotten stump or log.

1. **"Let's focus in on one evidence of change in this rotten log (stump)."**
2. **Pass out hand lenses and demonstrate how to use them (many people have never used one before).**
3. **Go on to Task E. "Notice that on Task E it says, 'Do not tear the stump apart!' Why do you think this note is there? Spend 10 minutes observing the log and recording your observations on and interpretations of Task E."**

TASK E (individuals or groups)

Do Not Tear The Stump Apart!

1. Record your observations and ideas below.

*Living things	Effect on stump
*Nonliving things	Effect on stump

2. In the space below, construct a diagram of one of the *cycles taking place in the rotten log or stump:

*You define the word *cycle* any way you want to.

Questions and Discussion

1. Ask for volunteers to share what their diagram or cycle looks like. If appropriate, comment how people defined and illustrated the word *cycle* differently.

V. COMMUNICATING INTERPRETATIONS THROUGH SKETCHING AND WRITING.

Distribute sketching paper and pieces of charcoal from a campfire or fireplace.

Questions and Discussion

1. "Sketch the log or stump you just studied, using charcoal from a campfire or fireplace. Other sketching materials will be given to you as you work." Subject of sketch depends on the environment. It can be anything that is significant about the area: a rotten log, stump, snag, old homestead, fence, barn, city building, transmission tower, or freeway.

2. While people are sketching, go around and give them rotten wood, brown dandelion leaves, green dandelion flowers, and other goodies in season.

3. If you're not in the woods, improvise.

Begin this part when about half the people finish their sketch.

Questions and Discussion

1. "Use your pencil or pen. Find a place on your sketch (across the bottom, or down the side) to write some things as I give you the directions."

2. Give these directions to the group:

   a. "Write two descriptive words about the stump (words that tell what it looks like)." Repeat instructions.

   b. "Write three action words about the stump (words that describe processes or changes taking place, or things happening to it)." Repeat instructions.

   c. "Now write a short phrase that tells how the stump affects the rest of the environment (a phrase describing its value or usefulness or a phrase describing any thought you have about the stump)." Repeat instructions.

   d. "Write one word that sums up everything about the stump (a word that suggests a comparison, an analogy, or synonym)." Repeat instructions.

   e. (Optional) "Now, if you wish, go back and give a title to what you have written."

   f. "Congratulations. You have just written a poem about the stump or whatever you sketched."

3. Have people read their writings if they wish.

VI. TRANSFERRING THE PROCESS TO OTHER ENVIRONMENTS

This could be done inside, depending on outside conditions. The same processes could be used to investigate other environments.

TASK F

List some other things in this environment that could help us further interpret the forest.

Things in the forest	*What it can tell us about the forest*

Identify and list some of the methods and processes we used today in our investigation.

Describe how we could use these methods and processes in another environment to find out more about it (city, schoolyard, etc.).

VII. SUMMARY

1. Discuss Task F.
2. "What did we find out about the environment in our session today?" (List on chart, if there is time.)
3. "How are these things important to the way we manage the environment?"
4. "How can we summarize our investigations and discussions today?"
5. You may want the group to describe in writing how they felt about this session.

VIII. SOME OBJECTIVES

Behavioral Outcomes in Knowledge

1. As a result of these activities, each participant should be able to:
   a. List at least three observations about the cross-sections provided, and infer possible reasons for each observation.
   b. Describe ways to set up an investigation to find out more about the above observations and inferences.

c. Set up an investigation (collect and record data) to find out reasons for growth rate differences in a given stand of trees.

d. Describe activities appropriate to other environments for interpreting the landscape.

e. Identify and list at least three evidences of change in the environment, and infer the cause-and-effect relationships of those changes.

f. Construct a diagram of a cycle in a rotten stump.

Behavioral Outcomes in Feelings, Awareness, Values, and Action

2. As a result of these activities each participant should be able to:

a. Describe how he or she feels about one change in this environment.

b. Communicate feelings of awareness by constructing a sketch of a given object in the environment, using natural materials.

c. Communicate feelings, awareness, and values by describing in writing the effect of a given object on the environment.

IX. EQUIPMENT NEEDED (for a class of 30 people)

30 Cross sections of trees
6 Increment cores (preferably in plastic) from numbered trees
30 Hand lenses (optional)
30 Pieces of sketching paper
Lab sheets
Task cards
Natural materials for sketching

The tasks and discussion topics in this lesson are designed so that many can be done individually or in combination, depending upon the facilitators' objectives and time constraints.

It is suggested by the writers that continual plan revision be done by the people who use this plan.

TASK A (work in small groups)

Write down some things you notice about the cross sections.

TASK B (work in small groups)

Select three observations about the cross sections from the group list.
List possible reasons for these observations.
List ways you could set up an investigation to find out more about your observations and inferences.

Observation (What you noticed)	Inferences (Possible reasons for this)	Investigations (How we could find out)
1.		
2.		
3.		

Tree Rings Information.

The current year's growth is the ring next to the cambium layer just inside the bark. The rapid spring growth is a lighter color than the growth made in the summer, so one light and one dark ring makes one year's growth. It is easier to see and count the summer wood or dark rings to determine the age of a stump or log of a tree when it was cut.

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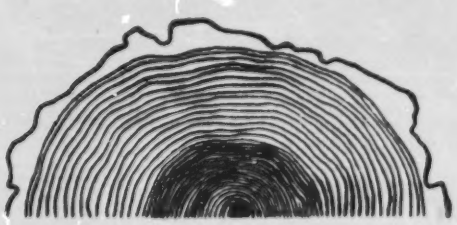


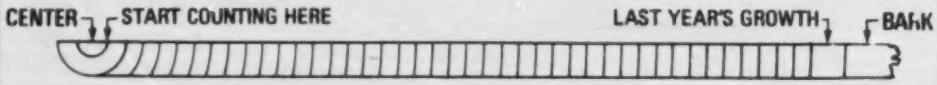
How old was this tree when it was cut? _____ The dark rings are summer wood and the light rings are spring wood. One light and one dark ring makes one year's growth.

TASK C (groups of 4-5)

1. Observe the tree core your group has been given and record the information.
   See drawing of tree core to help interpret the tree core you have been given.

Tree #	Number of dark rings from center to bark (approx. age)	Remarks about the ring patterns

DRAWING OF TYPICAL TREE CORE



2. When your group has recorded the information, one person from the group should put this information on the blackboard or easel board. Chart should be like Task C, step 2.

   Record the following information about tree cores from the master chart. Instructor will provide the diameter information.

Tree #	Number of dark rings from center to bark (approx. age)	Diameter of tree trunk (cir. ÷ 3)	Remarks about the ring pattern
1			
2			
3			
4			
5			
6			

3. Set up an investigation to find out reasons for some of the differences in the data.
   a. Select two or three trees from the list that show differences in growth rates.
   b. Which trees did you select? (indicate by number) _____
   c. Why did you select these trees? _____
   _____

4. Go with your group to the site of the trees you selected for investigation.

   a. *Collecting and recording data:* Record your observations.

   b. *Interpreting data:* Record possible interpretations of the above data.

   c. *Summarizing your investigation:* Write your group's summary below, including:

      What you were trying to find out
      What data you collected about it
      What interpretations you made
      What other data would you collect about your investigation.

TASK D

Look for evidence of change (natural and manmade) in the environment.
Record and fill out other columns.

Evidence of changes in the environment	What might have caused them?	Effect on the environment

TASK E (individuals or groups)

Do Not Tear The Stump Apart!

1. Record your observations and ideas below.

*Living things	Effect on stump
*Nonliving things	Effect on stump

2. In the space below, construct a diagram of one of the *cycles taking place in the rotten log or stump.

*You define the word *cycle* any way you want to.

TASK F

List some other things in this environment that could help us further interpret the forest.

Things in the forest	*What it can tell us about the forest*

Identify and list some of the methods and processes we used today in our investigation.

Describe how we could use these methods and processes in another environment to find out more about it (city, schoolyard, etc.).

a lesson plan for

INVESTIGATING SOME ANIMALS AND THEIR ENVIRONMENT

Set the stage for this investigation by reviewing quickly what will take place. For example, say: "During this session we will collect and interpret information that will help us identify some relationships that exist between animals and their environment in this area."

Note to facilitator: Both the metric and English systems of measurement are included in the lesson plan. If it has not already been determined, you should discuss and decide with the group which system will be used.

I. OBSERVING AND MEASURING ANIMAL SIGHTINGS AND EVIDENCE

Questions and Discussion

1. "What animals would we expect to find living in this area? (Vertebrate, invertebrate)
2. "What are the needs of these animals?"
3. "What are some names of the places where animals live?"
4. "Where would you look for animals around here?"
5. "What habitat conditions exist in this area that would be important to the animals?" (Vegetation, soils, moisture relationships, temperature)
6. "What evidence might we find that animals have been here?" (Sightings, sounds, smells, tracks, droppings, nests, burrows, partially eaten food)
7. "What are some guidelines that we need to consider so our investigation will cause the least impact on the environment?" List on task A.

Pass out Task A and go over instructions. (30 minutes)

TASK A (individuals or small groups)

1. List guidelines to use in minimizing the impact you will have on the environment while doing this task.

2. Explore as many places as you can from _____ to _____, and record any animals or evidence, or signs of animals (feathers, nests, scat, tracks, partly consumed food, etc.) and the numbers of each.

3. Observe and list different habitats for animals in the area (grass, cultivated fields, hedges, etc.)

4. List animal foods observed in the area.

Questions and Discussion

1. Discuss Task A.

2. Pass out Task B and go over instructions. (30-45 minutes)
   Have the group use the area used in Task A as one habitat if they want to.

II. COMPARING HABITATS

TASK B (small groups)

1. Select three different habitats in this area and record the data in the chart. Give each habitat a name based upon the characteristics that you record.

Habitat	I	II	III
Characteristics			
Name of Habitat			
Name and numbers of animals or evidence			

2. What could account for the similarities and difference among habitats?

Questions and Discussion

1. "What habitats did you explore?"

2. Break into three groups and have each group put the data for one habitat from Task B on a large piece of paper. Have each group put their display up and report on it (characteristics, animals there, or evidence). Use three different habitats. Record responses on board.

3. "What could account for the differences and similarities of the habitats?"

4. "What are some other animals that might live in the different habitats?"

5. "After looking at this information and our discussions, what can we say about habitats?"

III. OBSERVING AND DISCUSSING ANIMAL ADAPTATIONS

"Animals are adapted to their environment in many ways. What characteristics of an animal would we look at in determining why it lives in a particular habitat?"

Pass out Task C and go over instructions. Discuss Task C when group has finished. (20-30 minutes)

TASK C

List some things about the animals in this area that would enable them to live here.

Think about the characteristics, traits, and adaptations of the animals you have found in this area or that we would expect to find living here.
Fill in the following chart.

Animal	Things that enable them to live here (characteristics, traits, adaptations)	How it helps them live here
1. 2. 3. 4. 5.		

Optional Activities

If appropriate, during these activities say something such as: "The purpose of these activities is not necessarily to name the animals, although many of you know them from past experience. The purpose is to observe the different parts of animals up close and to make some inferences about where they live, what they eat, etc. If you are interested in the names of these animals, there are specific books on animal identification.

1. Animal Adaptation (20 minutes)

This activity can be done with the actual animal parts (skulls, pelts, stuffed mammals, and birds) or by using pictures of different animals cut or copied from encyclopedias, national wildlife magazines, Golden Nature Guides, Peterson field guides, etc.

Put the following parts of animals into separate piles and have about three or four participants around each pile.

5–6 skulls (carnivores, omnivores, herbivores)
5–6 study specimens (weasel, skunk, mole, chipmunk)
5–6 pelts (bobcat, coyote, fox, other raccoon)
5–6 birds (woodpecker, grossbeak, flicker, bluejay, hummingbird)

a. Adaptations of one part of an animal

Tell participants to list any types of adaptations that they can observe that will help infer: What type of habitat the animal might live in, where in the food chain it might be, and where this animal might live in the environment (names of animals are not important). Each group will then report their findings to the other groups.

At the end of each presentation, ask any questions that migh draw more information out of the group. For example, if the group didn't infer that the coyote and fox had developed the sense of smell, sight, and hearing because of a long nose, forward eye sockets and large ears, ask the group: "On the basis observable characteristics, which senses do you think have been highly developed in these two animals?" (If groups ask you questions about animal's names, etc., tell them to wait until we try to put some of the different group's reports together.)

b. Matching pelts and skulls

Put three or four skulls and the matching pelts or study specimens in the center of all four groups. Tell them, "Would somebody please match the skulls with the other parts of the animals?" Let the group solve the task without help from the facilitator.

After they have finished this part, say: "Each group had only part of an animal, so, on the basis of observable characteristics, they could only make certain inferences. Now, by adding another part of the animal and by pooling each group's observations, we know more about the animal."

c. Constructing a food chain using animal parts

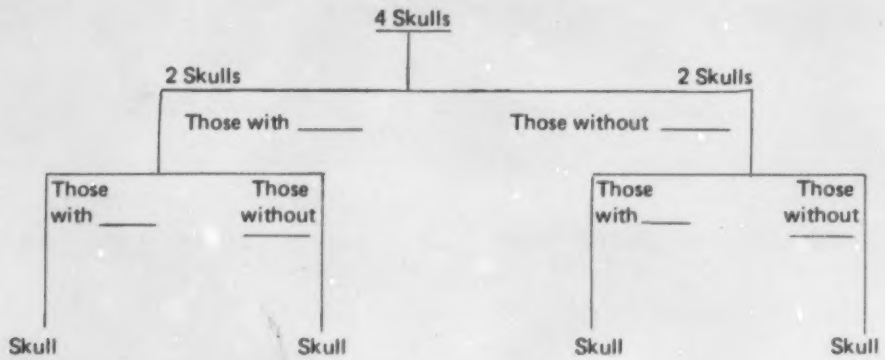
"Let's try something else." Put the mole, chipmunk, weasel, and coyote skulls and bobcat skin in a pile. Tell them, "Would somebody build a food chain from these parts of animals." After they have done that, say, "We have now put more data together to further interpret our information about these animals." Perhaps let each person draw or sketch the food chain.

2. Classifying Tooth and Mouth Adaptations for Food Use (20 minutes)

a. Developing a key

Give each group of five to eight a group of four to six skulls to classify. Among the skulls to classify it is desirable to have those from carnivores (fox, bobcat), herbivores (muskrat, chipmunk), and omnivores (bear, racoon).

Instructions:
- "Observe the skulls that you have been given. Look at the characteristics of their teeth and/or mouth."
- "Place the skulls into two piles on the basis of similarity and difference of their tooth or mouth characteristics. Try to use observations rather than inferences."
- "Make a large key on flip chart paper, starting with the two piles that you've made. Write the reason for the two piles you've made."
- "Continue to divide the two piles into two more piles and write the reason. Continue dividing the skulls until each has been singled out."



- "Leave your skulls and key and rotate to a key which another group has made. Try to place their animal skulls in the appropriate places on their key."

b. Grouping skulls by tooth structure

"Using the observations you made in developing your key, place the skulls in the three following categories:"

- Mainly sheering back teeth that cut like scissors - carnivore (meat-cutting)
- Mainly grinding back teeth, like human back teeth - herbivore (plant-eating)
- Both grinding and sheering back teeth, or teeth modified to do both cutting and grinding - omnivore (plant- and meat-eating).

IV. EXPLORING RELATIONSHIPS BETWEEN ANIMALS AND SOME ENVIRONMENTAL FACTORS

Food Chains

"One relationship among animals living in a particular environment is a food chain showing what animals eat and who eats them."

1. "What characteristics of an animal would we look at to determine what it eats?"
2. "What characteristics of an animal would we look at to determine what other animals eat it?"
3. "What do we mean when we talk about predator/prey relationships?"

Pass out Task D and go over instructions. (10 minutes)

> TASK D
>
> Using the information from Tasks A and B, construct at least a five-stage food chain that shows predator/prey relationships.

Questions and Discussion

1. Have groups share their food chains.
2. "How can numbers of animals help you determine a animal's position in the food chain?"
3. "How can animal adaptations help you determine a animal's position in the food chain?"

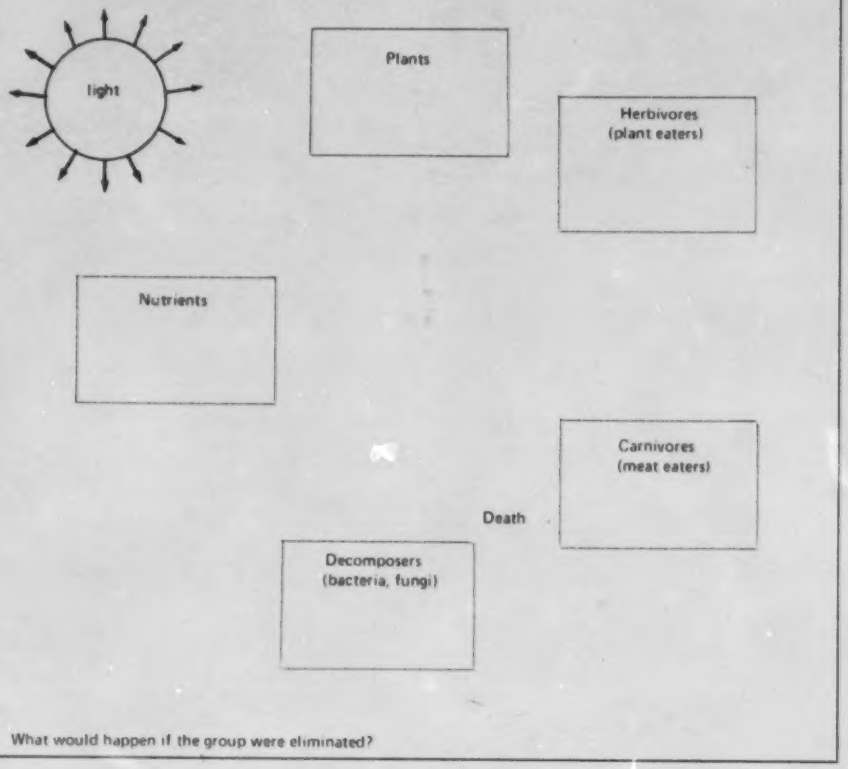
Energy Cycle

1. "Food chains illustrate the movement of energy through a portion of the environment."
2. "What do you think would happen to the food chain if that was the extent of energy flow in the environment?"
3. "Think about the diagram in Task E; place the appropriate organisms from your habitat in the appropriate places and draw arrows."

Pass out Task E. (15 minutes)

TASK E

List the animals or their evidences you have seen in the appropriate places in this diagram. *Put in arrows.* What other words and ways can you think of to illustrate a similar cycle?



What would happen if the group were eliminated?

Questions and Discussion

1. "What is the function of each part of the energy cycle?"
2. "What do you think would happen if the group you selected was removed from this ecosystem?"
3. "How does the energy cycle relate to a food chain?"
4. If no one talked about the decomposers, ask what they think would happen if that group were eliminated.

Relationship of Animals to the Environment

1. Pass out Task F and animal data cards. "Select one animal of your choice or use one of the animal cards and evaluate the area as to the suitability of the area for that animal." Ask people to take different animals so the area is evaluated for a variety of animals. Have reference guides to get information about different animals.
2. "Many times we use only our own value system in evaluating things for other people or purposes. It may help you, therefore, to do this task for the animal you picked by assuming the role of that animal." (30 minutes)

TASK F

Working with another person, evaluate this area for one animal. Fill out the animal data card below before doing the task, or use the data for one animal on the back of this card.

Animal Data

ANIMAL _____

Where it lives _____

Food needs _____

Predators _____

Other (adaptability to man, life span, reproduction rate, etc.) _____

_____

1. How would you rate the area for the animal's following needs:
   a. General habitat _____
   b. Winter and summer food supply _____
   c. Evidence of predators for your animal _____
   d. Other factors _____
2. How many of your assigned animals or their evidences did you find in the area?

   List some relationships you think exist among the animals of the same species already living there.

   How might the animals react to others of the same species moving in?
3. Which of the habitat types will these animals use?

   Where will they probably locate home, nest, den or burrow? Why?
4. What are some ways that this species of animal affects this environment?
5. Summarize how the animal assigned to you might react to living in this environment.

Questions and Discussion

1. "What do you think are some of the relationships among animals that live in this area?"
2. On the basis of our observations and discussion so far, how can we summarize the relationship between animals and their environment?"

V. DISCUSSING CHANGES IN ANIMAL HABITATS

Questions and Discussion

1. "Are habitats always the same?"

2. "What kinds of influences can cause changes?"

Pass out Task G. (10 minutes)

> TASK G
>
> Describe in writing three influences that you observed that have changed the habitats in this area and the cause and effect relationships that occurred.
>
> Consider:
> a. Evidence of change, influence that cause it
> b. What the area may have looked like before the change occurred and the animals that lived there then
> c. What the area looks like now and what animals live there
> d. How the change affected the habitat and the animal species that did and do live there.

Questions and Discussion

1. Have individuals read their descriptions and compare different descriptions.

2. What evidences did you find that show man's influence in this area?

VI. COMMUNICATING FEELINGS, AWARENESS, AND VALUES

Go on to Task H. (10-15 minutes)

> TASK H (individuals or small groups)
>
> In addition to the factors we have collected information about today, list others that affect the wildlife and their habitat.

Factor	Who Is Involved	Influence on Animal

Ask for responses from Task H and discuss.

Optional Activity - Designing a Model Animal

"In our investigations today we have discussed some adaptations that animals have for living successfully in their environment. Let's put these adaptations together and design a model animal to live in one habitat found here."

Instructions: "Working in pairs, design a model animal that you feel would be best adapted to one habit found here. When you have finished, give your animal a name that seems to sum up its characteristics."

"Consider the following ideas in your sketch and identify the parts of the animal that you designed for the items listed below and any other items you consider:"

1. Adaptations for food gathering
2. Adaptations for defense, protection
3. Adaptations for seasonal changes
4. Major foods required (kind and amount)
5. Amount of habitat required for needs
6. Value of animal to environment.

VII. SUMMARY

1. Discuss results of Task H.

2. "What did we find out about animals in our field study session today?"

3. "Why are animals important in the environment?"

4. "How can we summarize our discussion and investigations today?"

5. "What methods and processes did we use in our investigations today?"
   (This may be useful for the first field session to identify processes used in the investigation.)

6. You may want the participants to evaluate the session by writing how they felt about it."

VIII. SOME OBJECTIVES

Behavioral Outcomes in Terms of Knowledge

1. As a result of these activities, you should be able to:

   a. Identify and describe three different habitat types
   b. Identify and describe six different animal adaptations
   c. Construct a diagram of a food chain or an energy cycle using the evidences of animal life observed
   d. Describe possible adaptations of certain animals that enable them to live in a particular environment.

Behavioral Outcomes in Terms of Feelings, Awareness, Values and Action

1. As a result of these activities, each participant should be able to:

   a. Evaluate one habitat for a particular species of animal
   b. Describe three things that come down in everyday life that will make the energy cycle and consumer habits more efficient and that will cause the least amount of harm to the ecosystem
   c. Design and sketch an animal well adapted to a particular habitat.

IX. EQUIPMENT NEEDED

Golden Nature Guides - zoology, mammals, fishes, reptiles, and amphibians

Task Cards

Animal data cards
Four or five each of animal skulls, skins, study mammals, birds, or pictures of the different parts of animals (for optional activities)

The tasks and discussion topic in this lesson are designed so that many can be done individually or in combinatio depending on the facilitators' objectives and time constraints.

It is suggested by the writers that continual plan revision be don by the people who use this plan.

TASK A (individuals or small groups)

1. List guidelines to use in minimizing the impact you will have on the environment while doing this task.

2. Explore as many places as you can from _____ to _____ , and record any animals or evidence, or signs of animals (feathers, nests, scat, tracks, partly consumed food, etc.) and the numbers of each.

3 Observe and list different habitats for animals in the area (grass, cultivated fields, hedges, etc.)

4. List animal foods observed in the area.

FIELD MOUSE
BEAVER
MUSKRAT
WOODCHUCK
PORCUPINE
FOX SQUIRREL
RACCOON
OPOSSUM
SHORT-TAILED SHREW
WEASEL
MINK
SKUNK

DEER MOUSE
COTTONTAIL RABBIT
SNOWSHOE HARE
BOBCAT
RED FOX
COYOTE
WOLF
WHITETAILED DEER
OTTER
BADGER
BLACK BEAR

TASK B (small groups)

1. Select three different habitats in this area and record the data in the chart. Give each habitat a name based upon the characteristics that you record.

Habitat	I	II	III
Characteristics			
Name of Habitat			
Name and numbers of animals or evidence			

2. What could account for the similarities and difference among habitats?

TASK C

List some things about the animals in this area that would enable them to live here.

Think about the characteristics, traits, and adaptations of the animals you have found in this area or that we would expect to find living here.
Fill in the following chart.

Animal	Things that enable them to live here (characteristics, traits, adaptations)	How it helps them live here
1. 2. 3. 4. 5.		

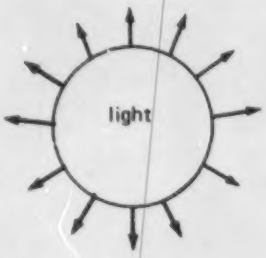
ANIMAL INVESTIGATION Task Card
Forest Service-USDA

TASK D

Using the information from Tasks A and B, construct at least a five-stage food chain that shows predator/prey relationships.

TASK E

List the animals or their evidences you have seen in the appropriate places in this diagram. *Put in arrows.* What other words and ways can you think of to illustrate a similar cycle?



Plants

Herbivores
(plant eaters)

Nutrients

Carnivores
(meat eaters)

Death

Decomposers
(bacteria, fungi)

What would happen if the group were eliminated?

TASK F

Working with another person, evaluate this area for one animal. Fill out the animal data card below before doing the task, or use the data for one animal on the back of this card.

Animal Data

ANIMAL _____

Where it lives _____

Food needs _____

Predators _____

Other (adaptability to man, life span, reproduction rate, etc.) _____

_____

1. How would you rate the area for the animal's following needs:
   a. General habitat _____
   b. Winter and summer food supply _____
   c. Evidence of predators for your animal _____
   d. Other factors _____
2. How many of your assigned animals or their evidences did you find in the area?

   List some relationships you think exist among the animals of the same species already living there.

   How might the animals react to others of the same species moving in?
3. Which of the habitat types will these animals use?

   Where will they probably locate home, nest, den or burrow? Why?
4. What are some ways that this species of animal affects this environment?
5. Summarize how the animal assigned to you might react to living in this environment.

ANIMAL INVESTIGATION Task Card
Forest Service-USDA

Evidence:

COTTONTAIL RABBIT

Droppings small 1/8"-1/4" (.3-.6 cm) diameter, tan to brown, round, glossy.

Burrows hidden in brushy places. Small 4"-5" (10.2-12.7 cm) diameter.

Narrow well-worn trains and resting forms under brush clumps.

Small twigs eaten and bark showing teeth marks near to ground level.

HABITAT: Brushy thickets with openings. Woodland areas with open sunlit patches, cover to hide in, and with winter food supply important. Weed cover and brushy fence rows good habitat areas.

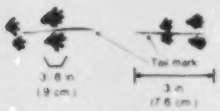
FOOD NEEDS: (summer) Many green succulent plants, weed seeds, grass. (winter) Small twigs and bark. Birch, willow and sumac used.

POPULATION: One rabbit per 4 acres (2 hectares) is considered a good population. Two rabbits per acre is considered high.

PREDATORS:
On adult and young: Most four-footed, winged, and reptilian predators, plus man.

Evidence:

DEER MOUSE



Droppings small 1/10"-1/8" long, oblong, shaped like rice grains.

Burrows 3/4"-1" (1.9-2.5 cm) diameter in the ground under fallen logs. Nests may be found in old buildings, in stumps, or even in standing dead trees. Usually grass and down construction.

Empty seed hulls from pine, spruce and fir units, acorns.

Bones found in owl pellets and droppings of predators.

HABITAT: Nearly every dry-land habitat is occupied somewhere by this species. Forests, grasslands, deserts, or combinations of the above.

FOOD NEEDS: Seeds, nuts, acorns, insects. Stores food for winter.

POPULATION: 5-10 mice per acre (1/2 hectare) is considered normal. 10-15 mice per acre is considered high.

PREDATORS: Owls, hawks, coyotes, bobcats, house cats, fox, skunks, weasel, snakes, almost all meat eaters.

Evidence:

MULE DEER

Scat: Roundish pellets about 1/4" (0.6 cm) diameter, from black to tan in color, usually a dozen or more in one place.

Hair on fences, hollow logs, etc., grey brown.

Hoof scrape tracks on fallen logs.

HABITAT: Conifer forests, desert shrub, chaparral, grassland with shrub, hardwood forest if browse plants present.

FOOD NEEDS: Shrubs and twigs most of the year, grass in spring. Favored foods include new growth of bitterbrush, mountain mahogany, chokecherry. Will also eat sagebrush, juniper, pine and fir boughs.

POPULATION: Variable density. May be 10-50 per sq. mile on winter range. 2-4 deer per square mile (0.6 square km) in summer.

PREDATORS: Man, dog, cougar, coyote, wolf.

TERRITORIALITY: Gregarious in winter (can live together).
LIFE SPAN: 2-10 years.
OFFSPRING: One or two fawns per year.
COMPATIBLE WITH MAN

Evidence:

COYOTE
(outer toes larger)

DOG
(front toes larger)

Dog-like droppings with hair, often [illegible] colored.

Partially consumed remains of animals, [illegible] bones broken.

Den under trees, rocky areas, logs; with openings 1'-1.5' (.3-.5 m) in diameter.

HABITAT: Prairies, desert, open woodlands, brushy and boulder-strewn areas. Usually not more than 6 miles (9.6 km) from water.

FOOD NEEDS: Small rodents, rabbits, mice, almost any weak or old animal, the young of most animals, vegetation, carrions, almost anything.

POPULATIONS: One per sq. mile where found. Hunting route about 10 miles (16.9 km).

PREDATORS: On young: bobcats eagles, dogs. On adults: man.

LIFE SPAN: 2-10 years
OFFSPRING: One litter of 5-10 pups/year.
QUITE TERRITORIAL
COMPATIBLE WITH MAN

Evidence:

RACCOON

Dens in hollow trees, caves, logs, ground burrows. Opening 1' (.3 m) diameter.

Scat loose, often found on logs, and often contain shells of crayfish, fresh water clams, seeds, etc.

HABITAT: Wooded areas along streams and lakes, corn fields.

FOOD NEEDS: Principally fruits, nuts, grains, insects, crayfish, bird eggs, almost anything.

POPULATION: One animal per 15 acres is considered high. Depends on food supply.

PREDATORS: Man, dog, coyote.

TERRITORIALITY: Not a strongly territorial animal.

LIFE SPAN: 10-14 years
OFFSPRING: One litter/year. Average of four/litter.
DOES NOT TRULY HIBERNATE
COMPATIBLE WITH MAN
OTHER: Meat edible, animal primarily nocturnal, valuable furbearer.

Evidence:

WOODPECKER

The sound of tapping or drumming.

Drill holes in dead trees, logs, fence posts, and telephone poles.

Nests in 1.5"-3" (3.8-7.6 cm) diameter holes in trees, posts, etc.

Sightings of black and white birds that show a "dipping" flight pattern.

(bird flying in dipping pattern)

HABITAT: Forests with some dead trees may use telephone poles, old buildings, etc.

FOOD NEEDS: Eats wood-boring insects, grubs, wood ants, insects.

POPULATION: About one pair of woodpeckers for every 40 acres (16.2 hectares) of forest land is average.

PREDATORS: (Almost no animals bother woodpeckers.) Opossums, snakes, and some kinds of birds may eat their eggs.

TERRITORIALITY: Often defend their territory against other woodpeckers.

OFFSPRING: Woodpeckers lays 3-6 eggs each year.

COMPATIBL[illegible] MAN

TASK G

Describe in writing three influences that you observed that have changed the habitats in this area and the cause and effect relationships that occurred.

Consider:

a. Evidence of change, influence that cause it
b. What the area may have looked like before the change occurred and the animals that lived there then
c. What the area looks like now and what animals live there
d. How the change affected the habitat and the animal species that did and do live there.

TASK H (individuals or small groups)

In addition to the factors we have collected information about today, list others that affect the wildlife and their habitat.

Factor	Who Is Involved	Influence on Animal

ANIMAL INVESTIGATION Task Card
Forest Service-USDA

a lesson plan for

A LAND USE SIMULATION

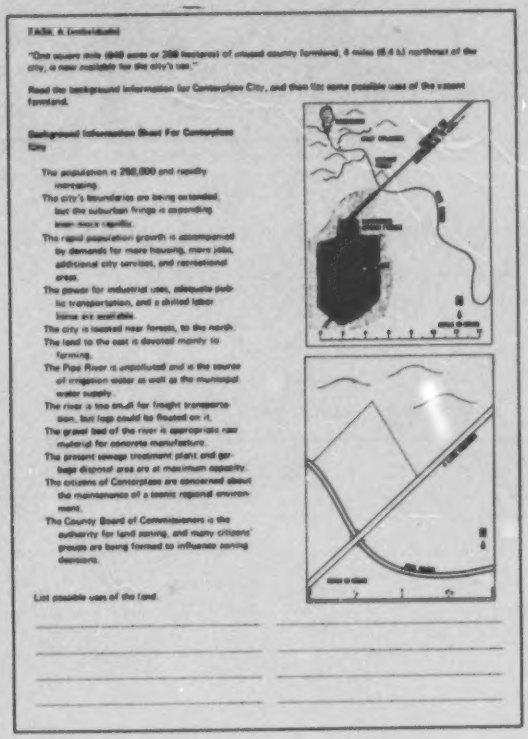
Set the stage for this investigation by reviewing quickly what will take place. For example, "During this activity, we will participate in a simulation game concerning land use in a hypothetical community, analyze what we have done, and discuss some ideas and ways for you to develop your own simulation game about local environmental issues or concerns." The techniques combine elements of simulations, games, and role-playing. Participants assume the roles of decisionmakers in a simulated environment and compete for certain objectives according to specified procedures and rules.

Note to facilitator: Both the metric and English systems of measurement are included in the lesson plan. If it has not already been determined, you should discuss and decide with the group which system will be used.

I. NAMING, RECORDING, AND CLASSIFYING POSSIBLE USE OF LAND

1. Distribute Task A. Read the problem to the group and then have them read the given information on Task A and list possible uses of the land to meet the city's needs.

2. "The problem is to identify some possible uses for the 1 square mile (640 acres, or 259 hectares) of county farmland, 4 miles (6.4 k) northeast of the city."



TASK A (Individual)

"One square mile (640 acres or 259 hectares) of unused county farmland, 4 miles (6.4 k) northeast of the city, is now available for the city's use."

Read the background information for Centerplace City, and then list some possible uses of the vacant farmland.

Background Information Sheet For Centerplace City

- The population is 250,000 and rapidly increasing.
- The city's boundaries are being extended, but the suburban fringe is expanding even more rapidly.
- The rapid population growth is accompanied by demands for more housing, more jobs, additional city services, and recreational areas.
- The power for industrial uses, adequate public transportation, and a skilled labor force are available.
- The city is located near forests, to the north.
- The land to the east is devoted mainly to farming.
- The Pine River is unpolluted and is the source of irrigation water as well as the municipal water supply.
- The river is too small for freight transportation, but logs could be floated on it.
- The gravel bed of the river is appropriate raw material for concrete manufacture.
- The present sewage treatment plant and garbage disposal area are at maximum capacity.
- The citizens of Centerplace are concerned about the maintenance of a scenic regional environment.
- The County Board of Commissioners is the authority for land zoning, and many citizens' groups are being formed to influence zoning decisions.

List possible uses of the land.

Questions and Discussion

When most people have started to write down uses on Task A, go ahead with question 1.

1. "What are some possible uses for the undeveloped land?" As people respond, write all comments just as they are said. Instead of paraphrasing if they are too wordy, ask: "How shall I write that on the chart?" List all suggestions, specific or general. Number the items as you go along, to simplify identification later. When you feel that you have enough material, go on to question 2.

2. "Which of these possible uses are similar?" Designate similar uses by letters, symbols, or colors. When most are designated, or the group seems to run out of thoughts, *stop*. Changes items among categories if the participants change their minds. Do not get bogged down in the details of grouping. For example, if some people think one use should be in another category, then put that use in both categories and go on to the next step.

3. "What label could we give to all the items in the same category?" (Recreation, industrial, utilities, housing, commercial.)

II. DEVELOPING AND GIVING PRESENTATIONS

1. Divide the group into the number of land use categories identified, with not more than eight persons per section. Assign one of the categories to each group for them to represent. One way to set up groups is to have the total group count off by the number of categories identified.

2. Pass out Task B. Inform the participants, "You have 10 minutes to list and analyze the advantages and disadvantages of possible uses for the vacant land in the assigned category. You may consider those listed on the board plus any other possible uses you can think of in your category." It is important to stress that this task is to just analyze the uses of the land.

TASK B (in groups)

Group _____ Assigned Category of Land Use _____

Your only task is to analyze and list possible consequences of different land uses within your assigned land use category. Do not decide which is the best use.

Use	Advantages to land/people	Disadvantages to land/people

3. (After about 10 minutes) Tell the groups, "Your next task is to develop a land use plan for the area in your assigned land use category." (About 20 minutes) After each group has started their planning (5-10 minutes), go to step 4. If all the directions are given at first, many groups start drawing a map before considering different land uses.

4. a. "We have just received word that because of the current workload from reading environmental impact statements, the members of the Board of County Commissioners have all resigned. Each group has one minute to elect one member to represent them on the Board."

   b. One of the facilitators takes the new Board members to another room and:

   Passes out Task C and reviews it with them
   Tells them they have 15 minutes until the group meeting starts
   Has them concentrate on evaluation criteria first
   Tells the Board to elect a chairperson to preside during the group presentation
   Instructs the chairperson to read over the announcements at the bottom of Task C to the whole group.
   Group decides which staff person will be the timekeeper.

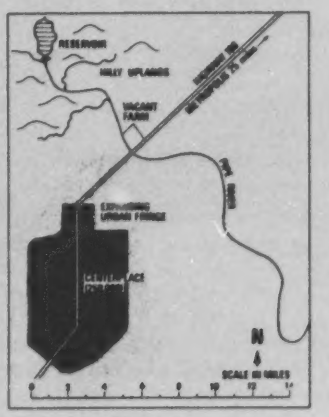
TASK C (County Board members only)

"One square mile of unused country farmland, four miles northeast of the city, is now available for the city's use."

1. Using this information, your task is to:
   a. Develop criteria to evaluate the proposals.
   b. Develop a system to record your evaluation of each proposal.

Background Information Sheet For Centerplace City

The population is 250,000 and rapidly increasing.
The city's boundaries are being extended, but the suburban fringe is expanding even more rapidly.
The rapid population growth is accompanied by demands for more housing, more jobs, additional city services, and recreational areas.
The power for industrial uses, adequate public transportation, and a skilled labor force are available.
The city is located near forests, to the north.
The land to the east is devoted mainly to farming.
The Pipe River is unpolluted and is the source of irrigation water as well as the municipal water supply.
The river is too small for freight transportation, but logs could be floated on it.
The gravel bed of the river is appropriate raw material for concrete manufacture.
The present sewage treatment plant and garbage disposal area are at maximum capacity.
The citizens of Centerplace are concerned about the maintenance of a scenic regional environment.
The County Board of Commissioners is the authority for land zoning, and many citizens' groups developing are being formed to influence zoning decisions.



Group Making Presentation (use category)	Criteria to Evaluate Proposal (Rating)					
	1	2	3	4	5	6

Elect a chairperson to preside during the presentations to the group and to run the meeting in an orderly manner. (5 minutes) Announcements to be made by chairperson:

- Because of time constraints, there will be no rebuttal after presentations.
- The Board may ask two or three clarifying questions of each group after all the presentations.
- You have 3 minutes to give your presentation. You will be given a warning when you have 1 minute left.

c. After the Board leaves the room, make this announcement.

"You have about 15 minutes to finish your plan and develop a 3-minute presentation to be made to the County Board of Commissioners. Your 3-minute presentation must include a visual display, such as a land use map, as a part of your presentation, and more than one person in each group must participate in making the presentation." Pass out markers and large paper to each group.

5. When all groups are ready, have the Board enter the room and sit at the front. The chairperson makes the announcements from Task C and sticks to them, in order to keep the process moving. The timekeeper is to stop all presentations at 3-minutes and give 1-minute warnings.

6. When the presentations are finished, the Board retires for 5 to 10 minutes to select the best proposal.

7. "While the Board is meeting, each group is to develop a list of criteria that they think should be used in evaluating the plans submitted." Pass out Task C to use in developing the criteria.

8. The County Board re-enters the room, reads their criteria aloud, announces their decision, and reads criteria used in making the decision. Board adjourns.

Person in charge must move rapidly to the next question to avoid shouting matches between losing groups. Have Board members return to the groups who selected them. The main purpose is to evaluate the process, not to get bogged down in the content of the issue.

Questions and Discussion

1. "What additional data would you have liked to have for planning your group's proposal?"

List example responses on board: Topography, vegetation, economy of area, railroad, shopping center, adjacent land, climate, soil survey, historical information, flood plain, wildlife, interest of board of control, money available, educational needs, regulations by State, existing zoning, political climate, population information (age needs, race, jobs).

2. "Where would you go to collect information on these topics?"

3. Point out to the group that this is one of the most important parts of the activity because it emphasizes that we need a variety of information and data before we can intelligently make a land management or environmental decision to best meet the needs of people and their environment. This list has many of the elements that need to be considered in studying a local environmental issue or concern. It also includes elements of all the curriculum subject areas (social studies, science, language, arts, etc.). We have to use, therefore, the total community as a classroom or learning environment to collect the information.

4. Discuss any case histories of teachers or groups using this approach.

III. ANALYZING CHARACTERISTICS OF SIMULATIONS

"One group of people working with simulation games has identified *at least* three basic characteristics of most simulation games: (Have on chart)

1. "There is a clearly defined problem.

2. "There are factors that influence the decision.

3. "There are individuals and groups interested in the decision."

IV. DEVELOPING YOUR OWN SIMULATION GAME

1. "The most exciting simulation games are ones people develop themselves, on the basis of local environmental issues in their community, State or region."

2. "Can you think of some current environmental issues in your own community around which you could develop a game?" Call for responses.

3. "For the next 30 minutes, work with one or two other people to develop the format for a simulation game based on a local land use issue or topic of your choice. At the end of the time, we would like to hear from several of you about what you have developed." Have copies of current newspaper articles available if participants want to use them. Pass out Task D.

TASK D (groups of 2 or 3)

DEVELOPING A SIMULATION GAME

Using a newspaper article about a local environmental land use problem, develop the format of a simulation game, considering the following items:

Identification of the problem or issue to be decided upon

Identification of some factors having an influence on the decision

Identification of individual or group roles (those people or groups that will be affected by, or interested in, the problem).

Other things you may want to consider in developing simulation games:

Establishment of conditions for the players (noting procedures, available resources, money, etc.)

Development of specific goals or objectives for players

Inclusion of limits, or rules for what is permissable behavior (time factors, trading, point system, money allocations, etc.).

V. SUMMARY

1. Discuss Task D.
2. "How can you use the techniques in this session in your job situation? In the classroom?"
3. "How could a game like this develop decisionmaking skills in environmental management?"
4. "How can we take this process and use it to involve the public in social and political decisionmaking action projects in the community?"
5. "How can we summarize the use of simulation games in environmental interactions?"
6. "Simulation games can help people to understand problems in the environment and develop awareness and concern about these problems and the skills needed for citizen action and involvement in environmental management."
7. You may want the participants to evaluate the session by writing how they felt about it.

VI. SOME OBJECTIVES

Behavioral Outcomes in Knowledge

1. As a result of this session, each participant should be able to:
   a. Identify and describe three component parts of simulation games
   b. Construct his or her own simulation game based on a current environmental issue
   c. Name and describe at least 10 important types of data needed before making a land management decision
   d. Identify cause and effect relationships that exist in environmental management
   e. Describe alternative solutions to solving a specific problem.

Behavioral Outcomes in Feelings, Awareness, Values, and Action

1. As a result of this session, each participant should be able to:
   a. Describe how the information in Part III could affect their life, community, and the management of the environment
   b. Outline a plan of action to develop their own land use simulation model.

VII. EQUIPMENT NEEDED

Blackboard and chalk or easel and markers
Newsprint or butcher paper (enough for each group to make visual display)
Markers (four colors for each group to make visual display)
Masking tape
Task Cards
Commercial games on display (optional)

The Centerplace city problem has been adapted with permission from the May 1970 Journal of Geography from the article, "A Land Use Alternatives Model for Upper Elementary Environment Education," by Dennis Asmussen and Richard Cole, University of Washington.

The tasks and discussion topics in this lesson are designed so that many can be done individually or in combination, depending upon the facilitators' objectives and time constraints.

It is suggested by the writers that continual plan revision be done by the people who use this plan.

TASK A (individuals)

"One square mile (640 acres or 259 hectares) of unused county farmland, 4 miles (6.4 k) northeast of the city, is now available for the city's use."

Read the background information for Centerplace City, and then list some possible uses of the vacant farmland.

Background Information Sheet For Centerplace City

The population is 250,000 and rapidly increasing.

The city's boundaries are being extended, but the suburban fringe is expanding even more rapidly.

The rapid population growth is accompanied by demands for more housing, more jobs, additional city services, and recreational areas.

The power for industrial uses, adequate public transportation, and a skilled labor force are available.

The city is located near forests, to the north.

The land to the east is devoted mainly to farming.

The Pipe River is unpolluted and is the source of irrigation water as well as the municipal water supply.

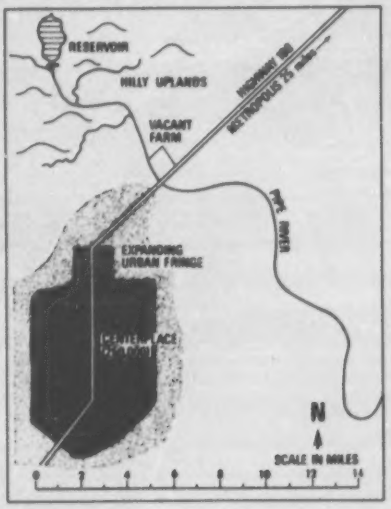
The river is too small for freight transportation, but logs could be floated on it.

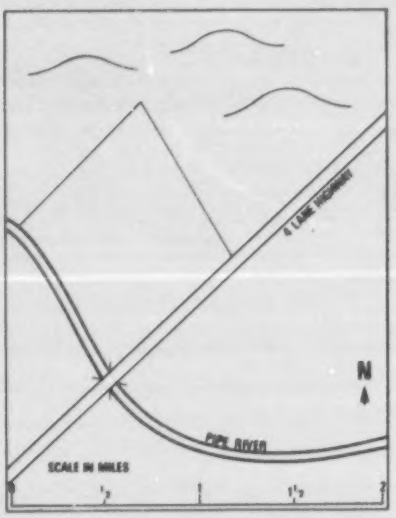
The gravel bed of the river is appropriate raw material for concrete manufacture.

The present sewage treatment plant and garbage disposal area are at maximum capacity.

The citizens of Centerplace are concerned about the maintenance of a scenic regional environment.

The County Board of Commissioners is the authority for land zoning, and many citizens' groups are being formed to influence zoning decisions.





List possible uses of the land.

_____ _____

_____ _____

_____ _____

_____ _____

LAND USE SIMULATION Task Card
Forest Service-USDA

TASK B (in groups)

Group _____ Assigned Category of Land Use _____

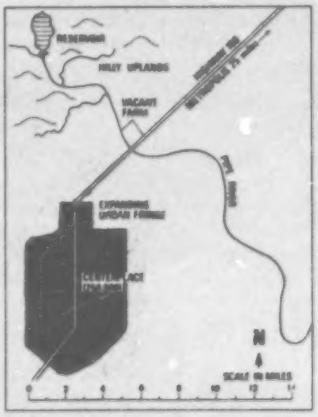
Your only task is to analyze and list possible consequences of different land uses within your assigned land use category. Do not decide which is the best use.

Use	Advantages to land/people	Disadvantages to land/people

TASK C (County Board members only)

"One square mile of unused country farmland, four miles northeast of the city, is now available for the city's use."

1. Using this information, your task is to:
   a. Develop criteria to evaluate the proposals.
   b. Develop a system to record your evaluation of each proposal.



Background Information Sheet For Centerplace City

The population is 250,000 and rapidly increasing.
The city's boundaries are being extended, but the suburban fringe is expanding even more rapidly.
The rapid population growth is accompanied by demands for more housing, more jobs, additional city services, and recreational areas.
The power for industrial uses, adequate public transportation, and a skilled labor force are available.
The city is located near forests, to the north.
The land to the east is devoted mainly to farming.
The Pipe River is unpolluted and is the source of irrigation water as well as the municipal water supply.
The river is too small for freight transportation, but logs could be floated on it.
The gravel bed of the river is appropriate raw material for concrete manufacture.
The present sewage treatment plant and garbage disposal area are at maximum capacity.
The citizens of Centerplace are concerned about the maintenance of a scenic regional environment.
The County Board of Commissioners is the authority for land zoning, and many citizens' groups developing are being formed to influence zoning decisions.

Group Making Presentation (use category)	Criteria to Evaluate Proposal (Rating)					
	1	2	3	4	5	6

Elect a chairperson to preside during the presentations to the group and to run the meeting in an orderly manner. (5 minutes) Announcements to be made by chairperson:

- Because of time constraints, there will be no rebuttal after presentations.
- The Board may ask two or three clarifying questions of each group after all the presentations.
- You have 3 minutes to give your presentation. You will be given a warning when you have 1 minute left.

LAND USE SIMULATION Task Card
Forest Service-USDA

TASK D (groups of 2 or 3)

DEVELOPING A SIMULATION GAME

Using a newspaper article about a local environmental land use problem, develop the format of a simulation game, considering the following items:

Identification of the problem or issue to be decided upon

Identification of some factors having an influence on the decision

Identification of individual or group roles (those people or groups that will be affected by, or interested in, the problem).

Other things you may want to consider in developing simulation games:

Establishment of conditions for the players (noting procedures, available resources, money, etc.)

Development of specific goals or objectives for players

Inclusion of limits, or rules for what is permissable behavior (time factors, trading, point system, money allocations, etc.).

a lesson plan for

INVESTIGATING THE HUMAN COMMUNITY

Set the stage for this session by reviewing what will take place. For example: "During this session we will identify parts of a human community. Look at the pattern of land use, construct a procedure and plan to investigate one part of the community, collect some data, analyze different solutions, and then develop an action plan to implement one of your solutions or recommendations."

Overview of the Process

The procedure outlined in this process falls into the following 10 basic steps or phases and could be used as a check-list for preparing almost any investigation.

I. BECOMING FAMILIAR WITH THE COMMUNITY

Identification of land use areas and patterns

II. IDENTIFYING AND FOCUSING ON LAND USE PATTERNS AND INTERRELATIONSHIPS

Overall view of the community
Construction of a three-stage data collecting chart

III. IDENTIFYING AND ANALYZING THE TOPIC FOR YOUR INVESTIGATION

Investigation with data that are observable, collectible, and recordable
Use of three-stage, data-collecting chart to analyze investigation
Construction of a data-collecting and recording device to use in investigation
Development of a procedure to test out the investigation process

IV. CONDUCTING THE INVESTIGATION

Testing of the investigation process
Modification of the procedures, data collecting tools, etc.

V. PREPARING AND REPORTING ON THE INVESTIGATION

Description of the process, procedures, and modifications made in the investigation process (this step is not giving solutions to the subject or content investigated)

VI. ANALYZING FACTORS AND ALTERNATIVES TO THEIR PRESENT CONDITIONS

Listing of factors that contribute to problems
Brainstorming of changes (elimination, modification, substitution) affecting the problem

VII. DEVELOPING AN ACTION PLAN TO BRING ABOUT AN IMPROVEMENT OR SOLUTION TO AN ISSUE OR CONCERN JUST INVESTIGATED

Determining if solution is feasible
Development of plan of action for implementing solution or recommendations

VIII. COMMUNICATING FEELINGS, AWARENESS, AND VALUES

IX. IDENTIFYING A COMMUNITY BY USE OF THEMES

X. SUMMARIZING THE INVESTIGATION

Investigating Your Environment Series
Forest Service, United States Department of Agriculture
Revised 1978
HC-1

I. BECOMING FAMILIAR WITH THE COMMUNITY

Questions and Discussion

1. "What are some major land use categories found in most communities?" List on board responses; e.g., commercial, residential, recreation, industrial, etc.

2. Pass out map of local community being studied. Have each group locate the major land use categories on the map with marking pens.

II. IDENTIFYING AND FOCUSING ON LAND USE PATTERNS AND INTERRELATIONSHIPS

1. "After looking at your map and locating the land uses on it, what can you say about the pattern of land use in your community?" List on board.

2. "We want to find out more about the different land use categories in this area."

3. "One tool that can help us is to construct a three-stage, data-collecting chart."

4. "As an example, let's do one together." Pick a subject other than a land use category listed on the board to illustrate the use of the chart.

   a. "Let's pick *Transportation* as the topic to be investigated." Write transportation at the top of chart.

   b. "The first column is labeled *What we want to find out* about the topic." Write this at far left on chart and ask for group responses.

   c. "The second column is labeled *How to collect* information about the item listed in column 1." Write this heading next to column 1 and ask for group responses. Ask for ways to collect information on the first four to five items in column 1, one at a time, then ask, "Are there any additional ways you can think of to collect the information in column 1?"

   d. "The third column is labeled *How to record* the information we are going to collect." Write this heading next to column 2 and ask for group responses. Just ask for general ways to record the information for any items.

   Here is what a chart might look like after doing it with the total group.

Three-Stage, Data-Collecting Chart
Subject: Transportation

Column 1 What we want to find out	Column 2 How to collect	Column 3 How to record
Location of major arterials	Observation	Graphs
Kinds of transportation	Interview people	Statistics
What is needed	Existing studies	Pictures
How much is available	Count number of cases at certain place	Film
Accessibility of terminals	Count types of vehicles	Tape recorders
Land topography		Questionnaire
Is it working		Map
What is being used now		Tables
Growth pattern		
Traffic flow pattern		
Peak traffic needs		
Attitude of people		

Questions and Discussion

1. "What might be the benefits of analyzing a land use or topic this way before going out to do an investigation about it?" (Sample responses might include, it's easier to see all the parts of the topic; analyzing it breaks it down into manageable parts to study; you realize that problems aren't as simple as they seem.)

   Here are two additional options to consider instead of investigating land use categories in step 2, depending on the objectives of your plan.

   Option 1: If your objective is to investigate environmental factors, then use this question after step 2: "What are some factors that might affect the quality of the environment of the area on this map and in what ways will they affect the environment?" (List on chart.)

   Option 2: If your objective is to investigate a potential or existing problem, then ask this question after step 2: "What are some problems that might be created by the pattern of the land use in your community?"

III. IDENTIFYING AND ANALYZING THE TOPIC FOR YOUR INVESTIGATION

The following are criteria to be used by the facilitator in identifying an area to investigate:

–Within walking distance in the time segment allotted (3 hours of field investigation)
–A variety of land use categories
–Examples of changing land use
–Interesting to study.

1. Describe the area that the group is doing to investigate and have each person draw that area on his or her map.
2. Split class into appropriate number of study teams, (groups of 4-5) and have them pick a land use category. (Make sure all land uses have been taken.)
3. Have study teams identify the land use category they are going to investigate in the designated area and fill out column 1 of the three-stage chart in Task A. (15-20 minutes)

TASK A (small groups)

THREE-STAGE DATA COLLECTING AND ANALYZING CHART

Working in your group, fill out the land use category and column 1 of the chart below.

Land Use Category

Column 1 What we want to find out about our land use category in the area	Column 2 How to collect the information	Column 3 How to record the information

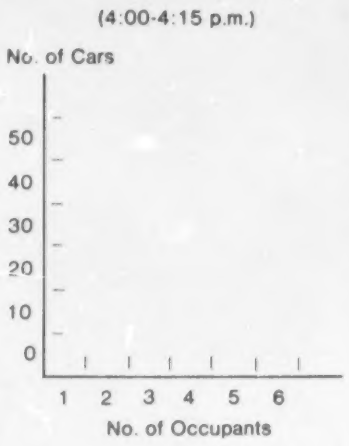
4. "Identify one or two items from column 1 of your chart that you want to find out more about from actual observations in the area to be investigated, and construct a data-collecting and recording device to use in collecting and recording your observations. The items you select must deal with data that are ***observable, collectible,*** and ***recordable*** in your area during the actual field investigation and within the time constraints. Filling out columns 2 and 3 may help in your planning." (30-45 min.)

5. Have sample data-collecting and recording charts to hang up as sample displays.

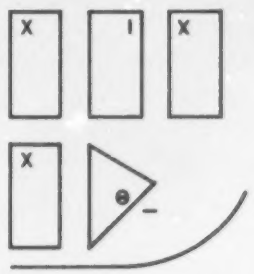
Use of Parks by Age Groups

Age Group	Swim	Walk	Bike	Other
0-6 yrs.				
6-13				
13-21				
21-30				
30-40				
40+				

No. of People in Cars at Intersection



Location of Public Services



6. When the groups have almost finished making the data-collecting charts, tell them to develop a plan of action to investigate their part of the environment using the data-collecting and recording devices in the allotted field time. (Consider dividing responsibilities for collecting and recording information, who goes where, other tools needed, etc.) Data must be observable, collectible, and recordable.

7. After 10 minutes into the planning, put up and read the following sign:

Planning for an Investigation

Usually, the problems that people have are deciding what to do and narrowing down the scope of the topic to something specific enough to actually investigate. Has your group experienced this?

8. Before going out to do the investigation, have each group make a short presentation to describe the procedures and to display the recording devices to be used in the investigation. If you have a large class, have groups pair up and critique each other's plans instead of each small group presenting it to the total group.

9. Just before dismissing the groups to do the field investigation, put up the following sign:

This Session is all About Learning How to Prepare for an Investigation

Today the procedures are more important than the content. The idea is to try out your data-collecting and recording methods

It may be necessary to modify your investigation procedures as you become involved in your task.

IV. CONDUCTING THE INVESTIGATION

Tell group: "You now have ___ hours to do your field work. Be back here at (time). You will then have 1 hour to prepare a 5-10 minute report about your investigation. Instructions for the report will be posted when you return."

V. PREPARING AND REPORTING ON THE INVESTIGATION

Have following instructions posted as groups come back so they have some guidelines for their presentation.

Instructions for the Presentation

1. Describe your task.
2. Report on what you did, how you did it, and what it meant.
3. Describe how you modified your procedure, methods, recording devices, etc.
4. Use more than one person as spokesman.
5. Use visual displays.
6. Limit report to 5-10 minutes.
7. This is a report about the investigation process and not the content or solutions to problems, unless it relates to the process.
8. Do not report on all the minute details.

Each group should give its presentation. Stick to time limits and to the process of the investigation.

1. "What problems did you encounter in your investigation?"

2. "What is the next thing to do with all this information?"

VI. ANALYZING FACTORS AND ALTERNATIVES TO THEIR PRESENT CONDITIONS

Questions and Discussion

1. "What are the basic functions of your study area?"

2. "What are some of the needs of the area?"

3. "What impact does your survey area have on the management of your community?"

4. "What examples are there in your area that:

   Illustrate the past
   Typify the present
   Indicate the future."

5. "What interrelationships can we identify in the area investigated, on the basis of your field observations (residential to business, past use to present use, business district to transportation routes, etc.)?"

6. "How do these things above affect the function of the community?"

7. "Select one issue, concern, or problem that you identified in your investigation. Using Task B, list and analyze as many factors you can identify." (30 minutes)

8. Have example shown on Task B on flip chart to show how chart should be used.

TASK B

ANALYZING FACTORS AND ALTERNATIVES TO PRESENT CONDITIONS

Task B is designed to brainstorm all possible alternatives. List the factors contributing to the issue. Take each factor and ask, "how can this factor be changed eliminated, modified, substituted to bring about a change in the issue? Consider all alternatives, no matter how silly they may seem.

Factor	*How It Contributes To The Problem or Issue*	*Alternatives To Its Present Condition* Select one or more alternatives below and describe how the factor might be changed. *Elimination Modification Substitution*	*Describe How The Change Will Affect The Problem Or Issue*
Example:	Traffic Management		
Width of streets	Causes traffic jams	Put in walking or bicycle paths	Eliminate car traffic, cause changes in working and social patterns
		One-way streets	Ease congestion because of one-way flow
		Mass Transit	Minimize number of vehicles, no congestion, less air pollution, etc.
Everyone starts and quits work at same time	Causes traffic jams	Adjust starting, closing, working hours	Spread out traffic over a longer period of time

Describe the alternative or combination of alternatives that might bring about an an improvement solution to the quality of the environment investigated. Give reasons for your choices.

After you have analyzed the factors in Task B, go on to Task C

VII. DEVELOPING AN ACTION PLAN TO BRING ABOUT AN IMPROVEMENT OR SOLUTION TO AN ISSUE OR CONCERN JUST INVESTIGATED

"Select one of the alternatives from Task B. Write it in Task C under *Suggested Solution* and complete the task. This can help you to determine if your solution is feasible or not and what course of action you should take for its implementation."

TASK C

DEVELOPING ACTION PLANNING TO BRING ABOUT AN IMPROVEMENT OR SOLUTION TO THE ENVIRONMENT INVESTIGATED

Select one of the solutions suggested by your group in Task B. Write it below under *Suggested Solution*. Complete the rest of the chart.

Action Planning For Problem-Solving

Suggested Solution	*Type Action Necessary To Implement The Solution*	*Identify Change Agents Who Could Help Implement The Solution*	*Implementation Steps To Problem Solution*	*Evaluation Methods. How Will you Follow Up And Evaluate The Effectiveness Of Your Action?*
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Technological
What kinds of technological action would be necessary to implement this idea?

Social
What kinds of social action would be necessary to implement this idea?

Political
What kinds of political action would be necessary to implement this idea?

Individual
What kinds of things could be done through individual action?

Groups
What kinds of things could be done by or through groups?
Informal
Formal (organizations)

Agencies
What kinds of things could be done by or through agencies?

What must be done? In what order? When?

Steps Target Date
1.
2.
3.

Questions and Discussion

1. Have group give reports on Task C.
2. "What are your recommendations for meeting future needs in this area?"
3. "If you were on the city planning commission, what guidelines would you develop for consideration for future developments in this area?"

VIII. COMMUNICATING FEELINGS, AWARENESS, AND VALUES

Write the following task on the board:

TASK D

Describe your part in implementing the action plan in Task C:
As a member of a community action group.
As a part of the political decisionmaking process in your community.

Questions and Discussion

1. Discuss individual comments.

2. "What type of community action can we take to identify and motivate people to collect, interpret data, arrive at alternative solutions, and take intelligent action to decide on the best solution consistent with the needs of the environment and society?"

IX. IDENTIFYING A COMMUNITY BY USE OF THEMES

We have just investigated a community environment using a topical approach of land use categories.

Another way to identify and investigate a district or community is by looking at themes. Themes can be one way to identify and define an area to investigate.

Have each person describe in writing the four items below for their own community or neighborhood.

1. "Describe where your neighborhood is."

2. "How do you get into your neighborhood?"

3. "What are some outstanding features of your neighborhood?"

4. "What is the central part of your neighborhood?"

Questions and Discussion

1. (Have these themes and their definitions on a chart.) One set of themes includes:
   - Pathways – Lines of movement (walks, bus routes, streets)
   - Nodes – Small areas of intensive focus where an observer may enter and feel a sense of belonging, safe, enclosed (small park, courtyard, intersection, intimate shopping center)
   - Edges – Linear breaks in continuity (freeway, river, edge of hills)
   - Landmarks – Identifiable objects or reference points (high-rise building, fountain).

2. Now have each person identify which description of their community was a pathway, node, landmark, or edge.

3. If possible, have a short slide presentation (10–15 slides) on examples of the themes from different scales and perspective.

4. "What are some themes in the area we studied yesterday?"

5. "We want to study an area using the thematic approach, and the categories of pathways, nodes, edges, and landmarks." Assign an area to each group; it could be the same area or new areas. Pass out Task E.

TASK E (small groups)

Identify and analyze the themes in your assigned area. Describe them in writing or sketch or photograph the themes in the area. Analyze the area's problem and potential in the chart below.

Pathways: Lines of movement (walks, bus routes, streets)
Nodes: Small areas of intensive focus where an observer may enter and feel a sense of belonging, safe, enclosed, (small park, courtyard, intersection, intimate shopping center)

Edges: Linear breaks in continuity (freeway, river, edge of hills)
Landmarks: Identifiable objects or reference points (high-rise building, fountain)

Use the following chart:

ITEM	THEME IT ILLUSTRATES	PROBLEMS TO COMMUNITY	POTENTIAL TO COMMUNITY

6. Have groups share results.

7. (Have on chart.) The following are some reasons for identifying themes.

   a. If community has only one theme, it is often a boring environment.

   b. If themes are varied and strong, then a strong exciting community environment can exist.

   c. If an area is dying out, nodes, points of interest, pathways, etc., might be created to strengthen the themes in ways that contribute to the livability of the community.

   d. You can identify a community or neighborhood by themes.

8. "Let's make a comparison of the two methods (thematic-topical) of looking at an area. Select four to six items in an area studied and describe them in thematic and topic terms."

Item	Theme	Topic
Park	Node	Recreation
Major street	Pathway	Transportation

X. SUMMARIZING THE INVESTIGATION

1. "What procedures did we use in our investigation today?"

2. "What did we find out about the environment in our study?"

3. "How will this process help you when you have students or community groups investigate things?"

4. "How can we summarize our discussion and investigation?"

5. You may want participants to evaluate the session by writing how they felt about this session.

XI. SOME OBJECTIVES

Behavioral Outcomes In Knowledge

1. As a result of these activities, each participant should be able to:

   a. Identify at least five different land use categories in an urban environment

   b. Name and describe three themes often found in communities.

   c. Construct a data-collecting and recording tool for some part of an urban environment for data that is observable, collectible, and recordable

   d. Describe a procedure to use in initiating an urban environmental investigation

   e. Identify at least three component parts of an urban environment

   f. Describe four interrelationships that exist among component parts of the environment.

Behavioral Outcomes in Feelings, Awareness, Values, and Action

2. As a result of these activities, each participant should be able to:

   a. Analyze factors and alternative solutions to present condition in an environment

   b. Identify forces and change agents that can be used for or against the improved livability of the area

   c. Describe what he or she can do to become involved in community action programs of identifying and suggesting solutions to local environmental problems

   d. Describe how he or she and the community can become involved in affecting the local political decision-making process through environmental urban investigations

   e. Describe three ways that themes can improve the livability of a community.

XII. EQUIPMENT NEEDED

Maps of the urban area to be investigated
Blackboard or newsprint and easel.
Felt-tip markers or chalk
Paper and pencils

The tasks and discussion topics in this lesson are designed so that many can be done individually or in groups, depending upon the facilitators' objectives and time constraints.

The information and procedures under the following five topics – Land Use Survey; Environmental Assets and Liabilities Survey; Community Facilities and Services Survey; Social Survey; and Micro-Urban Investigations – are included to give additional ideas and considerations in developing the different components of a community survey.

LAND USE SURVEY

1. Inventory and plot on map

List the major uses of land in the area.
Group these uses into appropriate categories.
Label the categories.
Develop a legend for plotting these data on the map.

2. Additional Information

DEVISE YOUR OWN METHODS TO COLLECT AND RECORD THESE DATA.
SUBMIT THE METHODS AND THE DATA, IN WRITING, TO YOUR GROUP LEADER AT THE END OF THE SESSION.

How does each land use affect the other land uses of the area?

What problems exist because of certain land uses?

What land use problems in this area are related to regional environmental problems?

What things are being done to the land that are compatible with the:
- Characteristics of the land?
- Needs of the people?

Which land uses are changing?

What proposed projects could affect land use patterns in this area?

NOTE: The above questions are designed to help you look for significant relationships among things in the environment. Time may not allow you to investigate all of the suggestions. ***Therefore, you will have to decide which things are most significant in the time allowed.*** Please feel free to add to the list, throw it away and start all over, etc.

Something to think about

For each of the land uses you investigate, ask yourself:
- Is it in a good location to serve its purpose?
- What does it do to the environment?
- What kind of an environment does it have?

ENVIRONMENTAL ASSETS AND LIABILITIES SURVEY

1. Inventory and plot on map

List the environmental assets of the area (physical and visual).
Examples:
- Historic landmarks, visual impact structures, natural features, and aesthetically pleasing entrance

List the environmental liabilities of the area (physical and visual).
Examples:
- Conflicting land uses, high traffic streets, residential overcrowding, poor paving, curbs, sidewalks, adverse natural features, and sameness of environment.

Group the environmental assets and liabilities into appropriate categories.
Label the categories.
Develop a legend for plotting these data on the map.

2. Additional information

DEVISE YOUR OWN METHODS TO COLLECT AND RECORD THESE DATA.
SUBMIT THE METHODS AND THE DATA, IN WRITING, TO YOUR GROUP LEADER AT THE END OF THE SESSION.

How do the environmental assets affect the rest of the area? Be specific.

How do the environmental liabilities affect the rest of the area? Be specific.

Which environmental assets have potential for serving as building blocks to improving the livability of this area?

What problems exist because of adverse environmental factors in the area?

What environmental problems in this area are related to regional environmental problems?

What proposed projects could affect environmental assets and liabilities in this area?

NOTE: The above questions are designed to help you look for significant relationships among things in the environment. Time may not allow you to investigate all of the suggestions. ***Therefore, you will have to decide which things are most significant in the time allowed.*** Please feel free to add to the list, throw it away and start all over, etc.

Something to think about

For each of the environmental assets and liabilities you investigate, ask yourself:
- Is it in a good location to serve its purpose?
- What does it do to the environment?
- What kind of an environment does it have?

COMMUNITY FACILITIES AND SERVICES SURVEY

1. Inventory and plot on map

   List the community facilities and services in this area.
   Group these facilities and services into appropriate categories.
   Label the categories.
   Develop a legend for plotting these data on the map.

2. Additional information

   DEVISE YOUR OWN METHODS TO COLLECT AND RECORD THESE DATA.
   SUBMIT THE METHODS AND THE DATA, IN WRITING, TO YOUR GROUP LEADER AT THE END OF THE SESSION.

   List the user groups for each category in step 1.

   What reasons can you give for the locations of each of the community facilities and services you listed in step 1?

   What needs of the people are being met by these facilities and services?

   What needs are *not* being met by existing facilities and services?

   What problems are associated with the *quantity* and *quality* of community facilities and services in this area?

   Which of these problems are related to regional environmental problems?

   What proposed projects could affect the use and effectiveness of community facilities and services in this area?

   NOTE: The above questions are designed to help you look for significant relationships among things in the environment. Time may not allow you to investigate all of the suggestions. ***Therefore, you will have to decide which things are most significant in the time allowed.*** Please feel free to add to the list, throw it away and start all over, etc.

Something to think about

For each of the community facilities and services you investigate, ask yourself:
- Is it in a good location to serve its purpose?
- What does it do to the environment?
- What kind of an environment does it have?

SOCIAL SURVEY

1. Inventory and plot on map

   Collect information about the population characteristics of the area.
   - Age, income, education, size of families, renters-owners, length of residence, etc.

   Develop a legend for plotting these data on the map.

2. Additional information

   DEVISE YOUR OWN METHODS TO COLLECT AND RECORD THESE DATA.
   SUBMIT THE METHODS AND THE DATA, IN WRITING, TO YOUR GROUP LEADER AT THE END OF THE SESSION.

   What needs of the residents are met by living in this area?

   What social problems exist in the area?

   Which problems associated with this area are related to regional environmental problems?

   What changing conditions in the area are creating problems for its residents?

   What proposed projects could:
   - Affect the life-style of people in this area?
   - Lead to a change in the population characteristics of this area?

   What are the attitudes of the people in this area toward:
   - Governmental and private services
   - Citizen needs
   - Overall quality of life in the area.

   NOTE: The above questions are designed to help you look for significant relationships among things in the environment. Time may not allow you to investigate all of the suggestions. ***Therefore, you will have to decide which things are most significant in the time allowed.*** Please feel free to add to the list, throw it away and start all over, etc.

MICRO-URBAN INVESTIGATIONS

In addition to major component parts or categories of an urban environment, there are many opportunities for small individual environmental investigations.

Investigations of this nature should be developed in writing along the same procedures as in this Lesson Plan.

TASK

Develop in writing an investigation about some part of the human environment.

a. Describe procedures in action or process terms.
b. State objectives in behavioral outcomes that indicate some minimal expectations in acquiring new knowledge and skills.

Here are some suggested micro-urban environmental investigations:

1. Correlation of observable weather conditions to air pollution index
2. Correlation of man-made sounds to noise pollution
3. Effect of signs and billboards on sight pollution
4. Effect of architecture on aesthetics
5. Impact of local shopping center on community
6. Supermarket survey (packaging, buying habits)
7. Interpretation of man-built landscape using architectural styles, etc.
8. Onservation and recording of life in a park
9. Under what conditions plant life can live in a blacktop environment
10. Determining the different responses of water-holding capacity and runoff to different types of man-made surfaces
11. Environment of a city tree
12. Determining what is in a city block
13. Noise pollution (determining where noises occur most frequently and which city noises can be reduced to minimize noise pollution)
14. Inventory and classification of historic structures within the central business district of your hometown and determining necessities for their protection
15. Identification of factors and development of tools to help in recording and interpreting air pollution indexes in the local community.

TASK A (small groups)

THREE-STAGE DATA COLLECTING AND ANALYZING CHART

Working in your group, fill out the land use category and column 1 of the chart below.

Land Use Category

Column 1 What we want to find out about our land use category in the area	Column 2 How to collect the information	Column 3 How to record the information

HUMAN COMMUNITY Task Card
Forest Service-USDA

TASK B

ANALYZING FACTORS AND ALTERNATIVES TO PRESENT CONDITIONS

Task B is designed to brainstorm all possible alternatives. List the factors contributing to the issue. Take each factor and ask, "how can this factor be changed, eliminated, modified, or substituted to bring about a change in the issue? Consider all alternatives, no matter how silly they may seem.

Factor	*How it Contributes To The Problem or Issue*	*Alternatives To Its Present Condition* Select one or more alternatives below and describe how the factor might be changed. *Elimination Modification Substitution*	*Describe How The Change Will Affect The Problem Or Issue*

Describe the alternative or combination of alternatives that might bring about an improvement or solution to the quality of the environment investigated. Give reasons for your choices.

After you have analyzed the factors in Task B, go on to Task C

TASK C

DEVELOPING ACTION PLANNING TO BRING ABOUT AN IMPROVEMENT OR SOLUTION TO THE ENVIRONMENT INVESTIGATED

Select one of the solutions suggested by your group in Task B. Write it below under *Suggested Solution*. Complete the rest of the chart.

Action Planning For Problem-Solving

Suggested Solution	*Type Action Necessary To Implement The Solution*	*Identify Change Agents Who Could Help Implement The Solution*	*Implementation Steps To Problem Solution*	*Evaluation Methods. How Will you Follow Up And Evaluate The Effectiveness Of Your Action?*
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

Technological
What kinds of technological action would be necessary to implement this idea?

Social
What kinds of social action would be necessary to implement this idea?

Political
What kinds of political action would be necessary to implement this idea?

Individual
What kinds of things could be done through individual action?

Groups
What kinds of things could be done by or through groups?
Informal
Formal (organizations)

Agencies
What kinds of things could be done by or through agencies?

What must be done?
In what order? When?

Steps Target Date
1.
2.
3.

HUMAN COMMUNITY Task Card
Forest Service-USDA

TASK E (small groups)

Identify and analyze the themes in your assigned area. Describe them in writing or sketch or photograph the themes in the area. Analyze the area's problem and potential in the chart below.

Pathways: Lines of movement (walks, bus routes, streets)
Nodes: Small areas of intensive focus where an observer may enter and feel a sense of belonging, safe, enclosed, (small park, courtyard, intersection, intimate shopping center)

Edges: Linear breaks in continuity (freeway, river, edge of hills)
Landmarks: Identifiable objects or reference points (high-rise building, fountain)

Use the following chart:

ITEM	THEME IT ILLUSTRATES	PROBLEMS TO COMMUNITY	POTENTIAL TO COMMUNITY

a lesson plan for

DEVELOPING ENVIRONMENTAL INVESTIGATIONS

An environmental investigation should be designed so that all participants can take an active part at their own level of ability and interest.

The investigation should have opportunities for the participant to make observations, collect and record data, make some type of interpretation of data and summarization of how those interpretations relate to the topic.

The following chapters are designed to give the participant some experiences to construct an environmental investigation.

I. Introduction Page EI-2
Teaching Process Skills
Survival Values in Learning
A major goal of teaching process skills is to develop the ability for each person to think for themselves.

II. Developing Task Cards Page EI-4 3 hours
Task cards can promote small groups and individual investigations with a minimum of teacher direction.

III. Using Questioning Strategy in Environmental Investigation Page EI-9 1 hour
The use of certain kinds of questions can help establish a learning climate that will encourage participation, discussion and interaction during the investigation.

IV. A Basic Question Sequence for the Interpretation of Data Process Page EI-12 2 hours
This question sequence can allow the group to interpret their own observations and recorded data about the topic.

V. Developing a Lesson Plan for an Environmental Investigation Page EI-16 1½ hours
If you put all the above pieces together you can come up with the start of a lesson plan for an environmental investigation.

VI. Miscellaneous (Reading) PAGE EI-18
Behavioral Objectives

Investigating Your Environment Series
Forest Service, United States Department of Agriculture
Revised 1978

Teaching P·ocess Skills

A major goal of teaching process skills is to develop the ability within each individual learner to function autonomously at the inquiry and proof level; i.e., the ability to obtain, organize, translate, interpret and apply bodies of knowledge, and to present proof of the validity of the process.

Have group do TASK A—Survival Values in Learning Chart

1. In groups of 3-4 discuss the chart and answer the 2 questions at the bottom.
2. Have groups share their ideas about the implication of the chart.

Some Implications about the Chart: Survival Values in Learning

This chart relates to *what you learn*, not in comparison to how you learn it.

The lasting or survival value of learning some things may not be a very productive use of our time. According to the chart we only remember about 35% of the facts and 50% of the conceptual schemes shoved at us after only 3 months.

We retain the ability to manipulate and operate things (machines, tie shoes, write, etc.) up to 70% of the learning experience. If the learning experience was designed for us to develop thinking skills and processes (gather, sort, analyzing, interpret and provide alternate solutions about problems) we could retain those skills at the 80% level of usefulness.

Therefore, we might assume that a person who has developed the ability to think for himself can collect and analyze factual data, develop a line of reasoning or contribute to the interpretation or solution of a problem or decision. Many times the learning experience deals only with memorizing facts and other information or concepts with no chance for putting that knowledge to work for us.

Before planning a workshop and other learning experiences, ask yourself—

1. Why am I doing this?
   To help people memorize facts, learn concepts or to think for themselves?

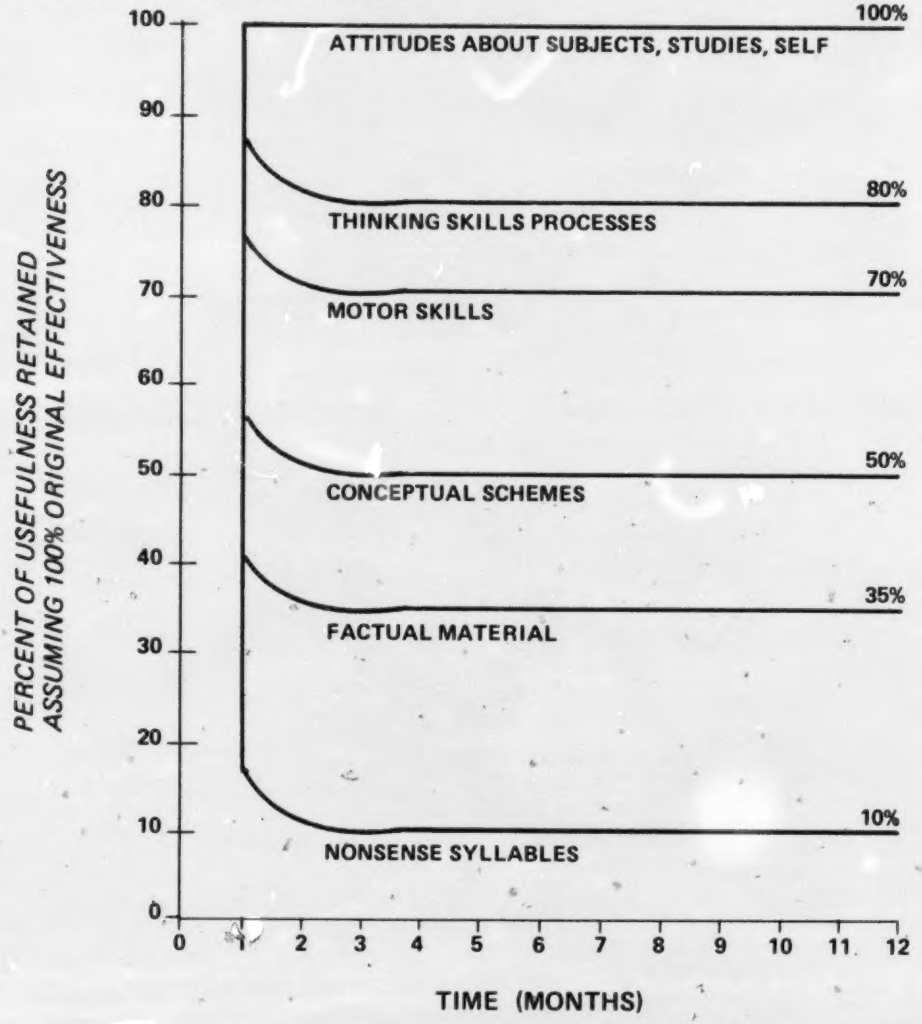
2. How can I structure learning experiences to insure participation and the development of thinking processes along with the use of factual data, etc.?

   We are now recognizing that if we develop thinking skills and processes of investigation, we may begin to change behaviors. Only by actually involving people in environmental learning experiences can they begin to think about their role in environmental management. We must be concerned with developing environmentally literate persons who can think for themselves.

TASK A

Survival Values in Learning

Used in the Higher Level Thinking Ability Course - N.W.E.R.L. - as an interpretation from *Educational Psychology*, Cronbach Harcourt Brace & World 1963.



This chart shows the retention rate of different categories of learning. In small groups discuss and answer the following questions.

What does this chart say about the retention of learning?

What are the implications of this chart to the way we plan learning experiences?

II. DEVELOPING TASK CARDS

In developing an Environmental Investigation Lesson Plan, self directed task cards can be a useful tool. They can promote individual and small group data-collecting and interpretation.

Task cards are not new and have been used in many ways. A task card can be simply a card on which you write the directions for a learning experience.

Questions and discussions

1. Pass out examples of task cards. Example: Use examples of Investigating your Environment Task cards, Milwaukie School District cards, American Geological Institute, ("Essence"), etc.

> Task A (30 minutes) (group 4-6)
>
> After looking at the task cards, that you have, list some reasons for using this method as one instructional help.
> Examples:
> 1. allows for different levels of ability to participate at once.
> 2. easily adjustable—can add or delete tasks
> 3. can promote small group interaction and accomplishment
> 4. teachers do preparation ahead of time
> 5. don't feel bound to manual
> 6. can tailor-make investigations to fit needs of students
> 7.
> 8.
> 9.

2. Make a composite list on the basis of all the contributions.
3. Point out that task cards can also have the following characteristics:

   Sequential, programmed, assorted, self-directed, personalized, task oriented, etc.

   Provide for a variety of kinds of—involvement, communication, feedback.

   Provide alternatives and choices for the learner—laminated for wet weather.

4. Ask the group if they can think of any other characteristics.
5. Have groups do Task B.

TASK B (30 minutes) (groups 4-6)

List other topics for task card ideas in the following grades.

Suggested assortment as samples:

Kindergarten - Primary (K-3)

Assorted topics based on observation, using the senses—

- sense of touch
- shapes
- colors
- sounds

Intermediate grades (4-6)

Assorted topics based on schoolyard and curriculum enrichment activities—

- developing observations (same as above)
- language expression
- schoolyard land use
- how-you-feel-about-the-schoolyard-type-activities
- science-on-the-schoolyard-type-activities

Non-graded (could be for any level to adults)

Assorted topics following an environmental action approach—

- developing and conducting a litter campaign
- inventory sources of Air Pollution
- improve your neighborhood
- consumer studies
- observe and interpret some aspect of management (wildlife habitat, timber management, stream survey, etc.)

6. List additional (on the board) ideas for each category, in Task B, from the group. (If time allows.)

TASK C Developing Task Cards (15 minutes) (small groups)

Using the following criteria, evaluate the sample task cards below:

1. Does the activity actually *involve* the *environment?* How?
2. Is the activity relevant to the learner in his world? (age level, topic, etc.)
3. Does the activity include opportunities for problem solving?
4. Does the activity include opportunities for the learner to collect and record data based on his own observations?
5. Does the activity include opportunities for the learner to make his own interpretation about the data he collects?

SAMPLE TASK CARDS

Circle the # for the criteria present on card

(From an assortment of task cards for a nature trail walk)

Here are two leaves.	1
Make a list of all the similarities you find.	2
Make a list of all the differences you find.	3
(Staple leaf here) (Staple leaf here)	4
Leaf 1 Leaf 2	5
Similarities:	
Differences:	

(From a sequence of task cards on "Sounds")

Find a noisy place and stay there for a little while.	1
How do you feel in a noisy place?	2
Write a few sentences or a poem to tell how the noisy place makes you feel.	3
	4
	5

(From a sequence of task cards on "Spaces")

Walk around your classroom.	1
How do you feel in this space?	2
Write or tell about how it makes you feel.	3
	4
Go outside and stand near the school building.	5
Do you feel different here than you do inside?	
Write or tell how this space makes you feel.	

(From a unit of study for a "Supermarket Survey")

In your backyard or schoolyard, bury different kinds of packaging materials. Dig them up at specified intervals of time and compare decomposition rates.	1
	2
	3
	4
	5

	Alum. Can	Glass Bottle	Plastic	Cardboard	Etc.
Sept.					
Oct.					
Nov.					
Etc.					

TASK D Developing Task Cards

In small groups (3-4) construct at least two task cards on a topic of your choice.

Some suggested Instructions for Cards:

select a topic or theme or a particular environment
decide on your purposes
select some activities to accomplish those purposes
construct task cards below about the topic or theme you chose
consider including a variety of-types of involvement
-sizes of groups
-lengths of time
-methods of recording or communicating information

When you finish, evaluate another groups' task cards using the criteria from TASK C.

Questions and Discussion

1. Have several articles of one page in length on environmental problems such as noise pollution, resource management, etc., and have small groups develop task card investigations from the article that meets some of the criteria from Task C.
2. Now that you have examined and constructed several task cards, what guidelines would you write for another group of educators to use in developing task cards?

Some example responses:

a. have one specific goal
b. keep task brief enough to maintain interest and sequence
c. color code them by areas of study or ability
d. keep directions simple
e. should fit within a time limit
f. some form of self-evaluation statement
g. use processes of observing, collecting, recording, and interpreting data

III. USING QUESTIONING STRATEGY IN ENVIRONMENTAL INVESTIGATIONS

One objective in learning is to help people develop thinking skills and processes that will allow them to interpret the data they collect. A good discussion and a good learning experience will happen if appropriate questions are asked. The use of certain kinds of questions can help establish a learning climate that will encourage individual participation, group interaction, and interpretation of the information collected in the investigation.

1. Ask each of the four questions below. Have each person write down as many things they can think of after each question. After they have written their answers to each question, ask how they felt about answering that question. Discuss.
   - What would happen if the rainfall doubled in your state next year?
   - How many acres of land are there in your state?
   - Why are recreation lands in your state important to the economy?
   - What are some things you think should be done in Environmental Education in your state?
2. Pass out TASK A (below)

TASK A Questioning Strategy (15 minutes)

Questions asked:

Question #1 - What would happen if the rainfall doubled in your state next year?

Question #2 - How many acres of land are there in your state?

Question #3 - Why are recreation lands in your state important to the economy?

Question #4 - What are some things you think should be done in Environmental Education in your state?

Get into groups of 3-4 and answer the following questions.

a) Which of the four questions did you feel most comfortable answering?
   1 2 3 4 Why?

b) Which question did you feel least comfortable answering?
   1 2 3 4 Why?

c) Which question allowed for greatest participation?
   1 2 3 4 Why?

3. Ask for verbal answers and discussions from the total group about TASK A.

4. The following is background information on the questions in TASK A. You may want to read it, or summarize it according to how the group discussion goes.

   Some people think that if you just ask questions, your problems are solved as far as getting involvement and group interaction. Asking questions doesn't necessarily insure more participation, better interaction, or higher levels of thought processes. *The kinds of questions you ask and when you ask them is important. As you can see from TASK A, different kinds of questions get different kinds of responses.*

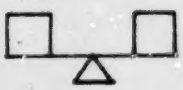
Many Systems

$\Delta = \Delta$

$\square = \square$

Memory or recall

Many factors affect one topic



Evaluative

Question 1 - What would happen if the rainfall doubled in your state next year?
This *divergent* or *open* type of question provides the opportunity to consider many different systems and try out many answers.

If you ask a question that allows a wide variety of responses, the participation will be more free. This allows more opportunity for creativity and imagination. (What would happen if. . . . . .? How might. . . . . .? What do you see. . . . . .?) Everyone can participate at his or her own level and, since the response depends on the viewpoint of the individual, there are no "wrong" answers.

Question 2 - How many acres of land are in your state?
This *memory* type question calls for remembered content, rote memory, or selective recall.

If you ask a question that has one correct answer, then people will go after the correct answer or the answer they think the leader is looking for. The kind of thinking that is going on is the recall of previously learned information and facts. (Who is. . . . . .? What is. . . . . .?)

Question 3 - Why are recreation lands in your state important to the economy?
This *convergent* type question represents the analysis of given or remembered information. It leads to one expected end result or answer.

If you ask a question that focuses on solving a problem or putting several pieces of data together, then the audience has to reason, using given or remembered data. (Why are these things so. . . . . .? How do you account for. . . . . .?)

The participant becomes a problem-solver in which the task is to apply the proper operations at the proper time.

Question 4 - What are some things you think should be done in Environmental Education in your state?
This *evaluative* type question asks the participant to use judgement, value, and choice, and is characterized by its judgmental quality.

The type of question you ask then, can affect the learning atmosphere and restrict or motivate the participants to become involved in the discussion.

5. Have Group do TASK B

   a) Which questions are similar? (*Not in their content, but in the kind of responses they would receive*)

   b) Put the questions that are similar into groups.

   c) Label (give name to) each grouping of questions.

   d) Use these labels to fill in the first column on the following chart.

   e) Complete the chart.

TASK B Questioning Strategy (30 minutes)

1. In groups of 3-4, identify the following questions that are similar. (similar in the kinds of responses they would receive, not in the content)

____a. What is a nuclear reactor?
____b. Why are the demands for energy doubling every 10 years in the U.S.?
____c. How do you account for the decreasing amount of open space in your community?
____d. What do you think is the best use of this land?
____e. Name the largest city in your state?
____f. Should numbers of coyotes be controlled? Why or why not?
____g. What would happen if all automobiles were banned within your city limits?
____h. How much land has been taken out of agricultural production in the U.S. in the last 5 years?
____i. What effect do trees and shrubs have on noise abatement?
____j. What factors contribute to the traffic congestion problem in your community?
____k. In your opinion, what are the 3 most important problems in your community?
____l. What is the relationship between population density and natural resource allocation?

2. Put the numbers or letters that represent each group identified in the chart below and label each group.

Groups	*Label each group of questions using your own names*

3. Put your labels in the chart below and describe your groupings.

Kinds of Questions (use the names you gave the groupings)	Characteristics of questions in this group
What does your chart tell you about the use of questions? 1. 2. 3.	

Questions and Discussion:

1. Discuss TASK B and particularly—What does your chart tell you about the use of questions? Ask different groups what ideas they come up with.

2. Here are some ideas to add to the groups comments:

   The kind of questions you ask affects the involvement level and atmosphere (bored, stuffy, uncomfortable, excited).

   The type of questions you ask can affect the number and type of responses you get from a group.

   Different types of questions can be used at different times in the course of a discussion.

   The kind of thinking that takes place can be affected by the kinds of questions being asked.

   The level of discussion within the group can be affected by the kinds and sequence of questions being asked.

   If you are aware of the difference in the kinds of questions, you can do a better job of analyzing the responses.

   Good discussions don't happen by accident.

3. Let's explore a basic question sequence usable as a part of an Environmental Investigation.

IV. A BASIC QUESTION SEQUENCE FOR THE INTERPRETATION OF DATA PROCESS

It can be important to develop a basic question sequence to allow people to interpret their own observations in the interpretation of data process.

There are four basic question categories that can be used in this process. Select a topic (common to all) about which they should write the questions. It could be something in the immediate area or room.

1. *Open Questions*
   Open questions are designed to provide an opportunity for *all persons to participate* and *to obtain a body of specific data* which will provide the opportunity to focus on significant points.

   This type of question provides an opportunity for every person to become immediately involved in the discussion, regardless of his or her ability or background. It is completely free of the element of "guess what's on my mind." Since the response depends on the viewpoint of the participant there are no wrong answers.

   THE CHARACTERISTIC OF THIS QUESTION IS OPENNESS
   "What do you see as you look at the hillside?"
   "What do you notice about the soil profile?"

   List two open questions that you could use *to allow as many people as possible to participate in a discussion*:

   _____

   _____

   Note: Interpretation of data may not necessarily begin with an open type question. You may wish to focus immediately upon specific points in the data. In that case, begin the question sequence with a focus question.

2. *Focusing Questions*
   The focusing question is an extremely important element in the interpretation of data process. It *focuses on specific points* that will later be compared, contrasted, and related to other points.

   Its basic purpose is to focus the attention on specific data as a central point for discussion.

THE CHARACTERISTIC OF THIS QUESTION IS SPECIFICITY
"What are some things that are helping the log decay?"
"What are some things that affect the quality of water?"

List two focus questions that you could use *to focus on a specific point for discussion.*

_____

_____

3. *Interpretive Questions*
Interpretive questions are designed to compare, contrast, and seek logical relationships between the specific points brought out in the focusing question(s).

The learner is asked to compare and contrast two or more specific points in the data; two or more groups of data; two or more feelings, concepts, or ideas, and express a perceived or inferred relationship between them.

THE CHARACTERISTIC OF THIS QUESTION IS ITS FOCUS ON RELATIONSHIPS
"Are there any of these that seem to belong together?"
"What can we say about the pH of the water from the aquatic life found there?"
"How do you account for the differences between these two areas?"
"Why were the two trees the same age but different in size?"

List two interpretive questions that you could use to *seek relationship between specific points.*

_____

_____

4. *Capstone Questions*
Capstone questions are designed to obtain conclusions, summaries and closing.

They occur at the close of a particular discussion and call for a statement which summarizes in a generalized form what has been discussed so the generalization or big idea applies to a variety of situations.

THE CHARACTERISTIC OF THE CAPSTONE QUESTION IS ITS CONCLUSIVENESS
"How could we summarize our discussion about architecture?"
"Based on our observation and discussion, what can we say about urban environments?"

List two questions you would use in summarizing or closing a discussion.

_____

_____

Questions and Discussions

1. Get into groups of 4-6 and do Task A.

2. Ask for examples groups have come up with.
Discuss—ask if it fits criteria listed on Task A.

TASK A Questioning Sequence (15 minutes)

In small groups (4-6) write down two examples of each of the four major question categories you have been asked in field investigation sessions so far.

OPEN (allow everyone to participate. Get out a lot of data)

1.

2.

FOCUS (focus attention on specific data as a central point for discussion)

1.

2.

INTERPRETIVE (seeks relationships—compare, contrast, relate specific points in the data)

1.

2.

CAPSTONE (calls for a statement which summarizes what has been discussed)

1

2.

Questions and Discussion:

1. Show film—(Environmental Awareness—11 minutes)

   Note: Other short, non-threatening films can be used. The demonstration of the questioning sequence should be modified to fit each individual film.

2. Involve the audience in discussing the film using one of the following question sequences.

Examples of Two Question Sequences
for
The "Environmental Awareness" Film

Here are three sets of questions for a facilitator's use in helping people discuss their thoughts about their environment.

a. Purpose: To explore different implications of the word "environment."
   What did you see in the film?
   What were the different kinds of environments shown in the painting?
   What were some of the things that were similar in each environment?
   What does the word "environment" mean?

b. Purpose: To explore some effects of change in the environment.
What did you see in the film?
What were the changes in the environments in the film?
What things were affected by changes in the environment?
How can we summarize our discussion about change in the environment?

3. Pass out Task B and have the audience identify, list and discuss the four major question categories just used in discussing the film.

TASK B Questioning Sequence

Identify, list and discuss the four major questions used to discuss the film.

_____ Film

QUESTIONS (List four major questions asked by leader)	State PURPOSE of each question
1.	
2.	
3.	
4.	

DEVELOPING YOUR OWN QUESTION SEQUENCE FOR INTERPRETATION OF DATA PROCESS

1. Show another short film (eg., Tree House, Sparkle, Garbage)

2. After film pass out Task C and have each group write a question sequence.

TASK C Questioning Sequence (20 minutes)

Working in groups of 3, construct a purpose and question sequence to use in discussion of the film just seen.

CRITERIA TO EVALUATE INTERPRETATION OF DATA QUESTIONS

Open - Allow everyone to participate. Get out a lot of data.
Focus - Focus attention on specific data as a central point for discussion.
Interpretation - Seek relationships. Compare, contrast, relate specific points in the data.
Capstone - Call for a statement which summarizes what has been discussed.

_____ Film

Purpose of showing and discussing film: _____

_____

Open question: _____

_____

Focus: _____

_____

Interpretive: _____

_____

Capstone: _____

_____

(Questions must relate to the purpose of discussing the film on whatever the subject is)

3. Have each group share and evaluate their question sequence with another group. (30 minutes)

V. DEVELOPING A LESSON PLAN FOR AN ENVIRONMENTAL INVESTIGATION

Working in a small group, select one topic in this area and develop your own 15-minute mini-investigation using task cards and the sequencing of questions and activities covered in this exercise.

Group members: _____

Purpose of Investigation: _____

_____

Evaluation: Is the purpose clearly defined? Yes No
Is it too general to be workable? Yes No

Pre-investigation questions, questions designed for maximum group responses and interaction—What can we find out about the rotten log? What might be important to look at?

Evaluation: Will the pre-activity question create interest and motivation to the audience to gather data? Yes No
Are the questions varied? Yes No

Task Card

Directions for gathering data for the investigation:
See "Developing Task Cards".

Data recording for the investigation (types of instruments, charts, graphs, tables, description, etc.):

Evaluation: Does the activity gather data that will help support the purpose? Yes No
Does the activity actually involve learner in collecting and recording data? Yes No
Does the activity include opportunities for learning to make his own interpretations? Yes No

Post Investigation Discussion

Open Question to bring out the "What's" (What did you notice?, What did you see?, etc.)

1. _____

_____

Focusing Question on specific points to be compared, contrasted, or related to other points of specific data (How do you account for . .? . Why are these things like that?)

1. _____

_____

2. _____

_____

Interpretive Questions to elicit comparing, contrasting, and relating of points within the field of data—What differences did you notice between rotten logs of the two different trees?

1. _____

_____

2. _____

_____

3. _____

_____

Capstone Question for summarizing generalizations—What can we say about. .? How can we summarize what we've done and discussed about the rotten log study?

1. _____

_____

Evaluation:	Does the question sequence lead the people to make generalizations that coincide with the purpose? Does each of the questions in the question sequence match up with the criteria below? Open - allow everyone to participate. Get a lot of data. Focus - focus attention on specific data as a central point for discussion. Interpretive - seeks relationships. Compare, contrast, relate specific points in the data. Capstone - call for a statement which summarizes what has been discussed.

I. BEHAVIORAL OBJECTIVES

Many instructional specialists contend that the single most important instructional advance of the past several decades is the current quest for clarity in the statement of educational outcomes. Today more than at any previous time in educational history, educators are being urged to clarify the descriptions of the outcomes they hope to achieve through their instructional efforts.

It is important that we be able to distinguish between instructional objectives which are well formed and those which are not. Well formed objectives possess a tremendous advantage over other objectives in that they *reduce confusion.* This confusion reduction leads to significant dividends in *planning instruction and evaluation.* The less confusion that surrounds a statement of an educational outcome, the more cues we have regarding what kind of instructional sequence will prove effective. The less ambiguity, the more readily we can devise precise measures to reflect that outcome. Well formed objectives thus constitute a useful mechanism for improving instruction and evaluation.
(From stating educational outcome S W Regional Laboratory for Education R & D)

SOME GUIDELINES FOR DEVELOPING OBJECTIVES OR PERFORMANCE TASKS

1. An objective describes an expected change in the learner's behavior.

2. When the learner has DEMONSTRATED this behavior the objectives have been achieved.

3. An objective is a group of words and symbols which communicate the expectation of the learner so exactly that the others can determine when the learner has achieved it.

4. A meaningful stated objective, then, is one *that succeeds in communicating your expectation for the learner.*

5. The best objective is the one that excludes the greatest number of possible *alternatives to your goal.* (No misinterpretation)

Cromwell Park School, Shoreline, Wash.

CRITERIA TO EVALUATE OBJECTIVES

1. Have you identified *who* the learner is?

2. Have you described the *behavior* the learner will demonstrate as evidence that he has achieved the performance task?

   Is it *measurable action or performance* by the learner? (see list of Action Words)

3. Have you stated the conditions you will impose upon the learner when he is demonstrating his mastery of the performance task?

   Examples:

   - using the length of his own step he will demonstrate _____
   - given a list of rocks he will distinguish _____
   - given a set of tree samples he will construct a dichotomous key _____
   - using a highway map of his state he will describe _____

ONE WAY TO SET UP YOUR OBJECTIVE

INSTRUCTIONAL OBJECTIVE: (put in phrases)

What will the learner be DOING?	Write:
What CONDITIONS will be imposed?	
How will success be RECOGNIZED?	

Now write the complete instructional objective below, evaluating it with the criteria above.

Select the statement in each number below that best describes what the learner will be DOING when demonstrating his achievement of the performance task.

1. Describe various things observed in nature.
   Describe four observable differences between the aquatic and the soil environments.

2. Describe accurately a land area.
   Construct a map of a predetermined land area by using compass bearings and distances.

3. Develop an appreciation of the aesthetics of our environment.
   Identify one thing in your environment that makes it more beautiful to you.

4. Demonstrate needed operations to calculate height of tree.
   Demonstrate how to measure the height of a tree using a stick longer than your arm.

ACTION WORDS

Here are nine action words from the American Association for the Advancement of Science that apply to curriculum related activities in the environment. These are not the only usable action words.

Identify - The individual selects a named or described object by pointing to it, touching it, or picking it up.

Name - The individual specifies what an object, event, or relationship is called.

Order - The individual arranges three or more objects or events in a sequence based on a stated property.

Describe - The individual states observable properties sufficient to identify an object, or relationship.

Distinguish - The individual selects an object or event from two or more which might be confused.

Construct - The individual makes a physical object, a drawing or written or verbal statement (such as an inference, hypothesis, or a test of any of these).

Demonstrate - The individual performs a sequence of operations necessary to carry out a procedure.

State a Rule - The individual communicates, verbally or in writing, a relationship or principle that could be used to solve a problem or performs a task.

Apply a Rule The individual derives an answer to a problem by using a stated relationship or principle.

BEHAVIORAL TERMS

The majority of our educational objectives can and should be stated in behavioral terms. It is recognized that there are some meta-objectives which must be more subjectively stated and performance subjectively measured. The terms listed below represent an effort to formulate a list of the most common and applicable terms which have meaning for the teacher developing objectives related to the areas of knowledge, skills and habits, understanding and concepts.

1. Describe
2. Interpret
3. Observe
4. Demonstrate
5. Sketch
6. Identify
7. Compare
8. Translate
9. Contrast
10. Relate
11. Generalize
12. Formulate
13. Define
14. Locate
15. Express
16. Analyze
17. Apply
18. Operate
19. Illustrate
20. Diagram
21. Perform
22. Listen
23. Write
24. Read
25. Review
26. Use
27. Present
28. Discover
29. Support
30. Question
31. Create
32. Calculate
33. Organize
34. Develop
35. Recite
36. Differentiate
37. Construct
38. Solve
39. List

TERMS TO AVOID IN STATING BEHAVIORAL OBJECTIVES

1. Enjoy
2. Appreciate
3. Faith
4. Understand
5. Like
6. Know
7. Grasp

TASK C Developing Task Cards (15 minutes) (small groups)

Using the following criteria, evaluate the sample task cards below:

1. Does the activity actually *involve* the learner in the *environment*? How?
2. Is the activity relevant to the learner in his world? (age level, topic, etc.)
3. Does the activity include opportunities for problem solving?
4. Does the activity include opportunities for the learner to collect and record data based on his own observations?
5. Does the activity include opportunities for the learner to make his own interpretations about the data he collects?

SAMPLE TASK CARDS

Circle the # for the criteria present on card

(From an assortment of task cards for a nature trail walk)

Here are two leaves.
Make a list of all the similarities you find.
Make a list of all the differences you find.
(Staple leaf here) (Staple leaf here)
Leaf 1 Leaf 2
Similarities:
Differences:

1 2 3 4 5

(From a sequence of task cards on "Sounds")

Find a noisy place and stay there for a little while.
How do you feel in a noisy place?
Write a few sentences or a poem to tell how the noisy place makes you feel.

1 2 3 4 5

(From a sequence of task cards on "Spaces")

Walk around your classroom.
How do you feel in this space?
Write or tell about how it makes you feel.

Go outside and stand near the school building.
Do you feel different here than you do inside?
Write or tell how this space makes you feel.

1 2 3 4 5

(From a unit of study for a "Supermarket Survey")

In your backyard or schoolyard, bury different kinds of packaging materials. Dig them up at specified intervals of time and compare decomposition rates.

	Alum. Can	Glass Bottle	Plastic	Cardboard	Etc.
Sept.					
Oct.					
Nov.					
Etc.					

1 2 3 4 5

DEVELOPING ENVIRONMENTAL INVESTIGATIONS Task Card
Forest Service-USDA

TASK D Developing Task Cards

In small groups (3-4) construct at least two task cards on a topic of your choice.

Some suggested Instructions for Cards:

select a topic or theme or a particular environment
decide on your purposes
select some activities to accomplish those purposes
construct task cards below about the topic or theme you chose
consider including a variety of-types of involvement
-sizes of groups
-lengths of time
-methods of recording or communicating information

When you finish, evaluate another groups' task cards using the criteria from TASK C.

TASK A Questioning Strategy (15 minutes)

Questions asked:

Question #1 - What would happen if the rainfall doubled in your state next year?

Question #2 - How many acres of land are there in your state?

Question #3 - Why are recreation lands in your state important to the economy?

Question #4 - What are some things you think should be done in Environmental Education in your state?

Get into groups of 3-4 and answer the following questions.

a) Which of the four questions did you feel most comfortable answering?
1 2 3 4 Why?

b) Which question did you feel least comfortable answering?
1 2 3 4 Why?

c) Which question allowed for greatest participation?
1 2 3 4 Why?

DEVELOPING ENVIRONMENTAL INVESTIGATIONS Task Card
Forest Service-USDA

TASK B Questioning Strategy (30 minutes)

1. In groups of 3-4, identify the following questions that are similar. (similar in the kinds of responses they would receive, not in the content)

___ a. What is a nuclear reactor?
___ b. Why are the demands for energy doubling every 10 years in the U.S.?
___ c. How do you account for the decreasing amount of open space in your community?
___ d. What do you think is the best use of this land?
___ e. Name the largest city in your state?
___ f. Should numbers of coyotes be controlled? Why or why not?
___ g. What would happen if all automobiles were banned within your city limits?
___ h. How much land has been taken out of agricultural production in the U.S. in the last 5 years?
___ i. What effect do trees and shrubs have on noise abatement?
___ j. What factors contribute to the traffic congestion problem in your community?
___ k. In your opinion, what are the 3 most important problems in your community?
___ l. What is the relationship between population density and natural resource allocation?

2. Put the numbers or letters that represent each group identified in the chart below and label each group.

Groups	*Label each group of questions using your own names*

3. Put your labels in the chart below and describe your groupings.

Kinds of Questions (use the names you gave the groupings)	Characteristics of questions in this group

What does your chart tell you about the use of questions?

1.

2.

3.

TASK A Questioning Sequence (15 minutes)

In small groups (4-6) write down two examples of each of the four major question categories you have been asked in field investigation sessions so far.

OPEN (allow everyone to participate. Get out a lot of data)

1.

2.

FOCUS (focus attention on specific data as a central point for discussion)

1.

2.

INTERPRETIVE (seeks relationships—compare, contrast, relate specific points in the data)

1.

2.

CAPSTONE (calls for a statement which summarizes what has been discussed)

1.

2.

DEVELOPING ENVIRONMENTAL INVESTIGATIONS Task Card
Forest Service-USDA

TASK B Questioning Sequence

Identify, list and discuss the four major questions used to discuss the film.

_____ Film

QUESTIONS (List four major questions asked by leader)	State PURPOSE of each question
1. 1.	
2.	
3.	
4.	